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THE PHILOSOPHY OF CLOTHING.

By W. Mattieu Williams.

HEAD-GEAR AND OLD FASHIONS.

ON the philosophy of head-gear but little need be said. "Man's bare back" is so exceptional, that it has been regarded as a puzzle by some biologists; but when we note that the position of the top of a man's head is, relatively to absorption and radiation, the same as that of a quadruped's back, the anomaly vanishes. In both cases that part which has the greatest need for such protection is the best protected naturally.

First as regards radiation. Bodies radiate equally in all directions, nevertheless, if a warm body shaped like the trunk of an animal were placed on the ground on a clear, cold night, it would not cool down equally on all sides. If placed upright the head would soon be the coolest. If lying on its side, the upper side corresponding to the back of the animal would cool more rapidly than any other part. The reason of this is that *all* bodies radiate, including, of course, the earth itself. Those parts of the body exposed to the terrestrial radiation would be receiving as well as losing heat, obliquely, it is true, as regards the upright sides, while the part presented to the clear sky would radiate into space, receiving very little indeed in return; therefore, the natural heat-retaining apparatus is most demanded on that part of the animal which is subject to perpendicular exposure—*i.e.*, the top of the head of man and back of quadrupeds.

But the hair does more than this. It serves as a protection against the excessive heat of the direct solar rays. These, coming from above, again demand the greater supply of hair on the part which is perpendicularly exposed. This demand is further increased by the fact that the brain and the spine are the most delicate organs of the body, and the most liable to serious injury from excess of heat. In the recent Soudan expedition, where our men were making roads and doing other work that exposed the back to the direct radiation of a tropical sun, they were provided with special spine-protectors. Many thousands of long pads to be worn along the spine, and thus imitate the extra back hair of hyenas, hogs, &c., were made at the Pimlico works, and were found to be highly beneficial.

The question of whether our natural head covering is sufficient or should be supplemented artificially is a fair one, but is not easily answered. Our bald-headed brethren can answer for themselves at once without any hesitation; but, as there are so many gradations between baldness and luxuriance, it is evident that no general answer can be given. I can only express an opinion in which I believe the majority of those who have studied the subject will concur—viz., that whatever fashion of head covering is used, it should be as light and as porous as possible, and that even this should never be worn unnecessarily.

I have observed that those who habitually wear warm head-coverings indoors become prematurely bald. My attention was first directed to this subject when working in a laboratory as a student of analytical chemistry. It was then, both in this country and Germany, a common habit or practice for professors, their assistants and pupils, to wear smoking-caps, or Kepis, or German burschen caps, all of cloth, and many lined rather thickly, some even padded with wool. I encountered a larger percentage of prematurely bald heads among the professors and their assistants than any other class. Subsequently, whenever I have my hair cut, I ascertain the opinion of the artist on this subject, and have found a near approach to unanimity among the most intelligent of hairdressers concerning the injurious effect of keeping the head too warm. They are perfectly unanimous as to the "strengthening" effect of keeping the hair cut short, and, after all due allowance for professional interests, I have no doubt that they are right.

The coolness thus obtained is doubtless an element in this strengthening of the hair, and there may be in addition an action analogous to that which induces increased growth of the cuticle when it is abraded.

It is said that the veteran chemist Chevreul, who has now entered his hundredth year, never wears a hat of any kind, indoors or out of doors, unless conventionally compelled to do so. In the August number of the *Popular Science Monthly* is a portrait of this very grand old man. One of its most striking—I may almost say startling—features is the luxuriance of hair.

One conclusion may be stated very positively—viz., that no artificial head clothing is equal to that supplied by nature, and therefore, if the artificial does damage to the natural, away with the artificial; throw up and away your hats, and cry "Vive Chevreul et chevelure!" I have acted on this principle for many years, never wear a hat in my own garden, or anywhere else where I am free, as a protection against cold or rain; only against the scorching rays of the summer sun, then a light straw hat with the lining ripped out; and have never taken cold in consequence.

The possibility of dispensing with head covering even in the midst of all our artificial surroundings, and in spite of inherited habit, is well shown by the boys of that shamefully-abused charity foundation, the London "Blue-coat School," where the sons of well-to-do and even wealthy people (some of whom denounce as pauperising Chamberlain's proposal to give free education to the poor) are freely educated, clothed, and fed. These boys have their hair close-cropped, and are only allowed very scanty caps that practically are of no use. They usually go bare-headed and nearly bare of hair. If this were injurious it would be shown in so large a number by the prevalence of some form of consequent disease among them. I have heard something about sunstroke, but

nothing serious. Those in Newgate-street have the protection of London smoke, but not so at Guildford.

The fashion of clothing is a subject beyond my reach. If I attempted to treat it in detail, Mr. Proctor would possibly ask where the "philosophy" comes in, and I should find some difficulty in replying.

There are, however, a few general principles bearing on this part of the subject that may be briefly stated. One of these is that clothing should never have the character of bandages, should never interfere with the free and natural movement of the body. When I was a young man no male person was admissible in "good society" without a "cravat" or "stock." I painfully remember my own struggles against this despicable, conventional tyranny, and the abominations with buckles behind, which, in spite of my revolutionary predispositions, I was sometimes compelled to wear. When I cast them off, liberated my imprisoned neck, and wore a small tie and turned down the ear-cutting and stiff-starched upright collar, I was sneered at as a conceited puppy, mimicking Lord Byron. Now I can dispense with any necktie whatever, have done so for more than twenty years past, and am no longer insulted. I name this as one of the evidences of rational progress and the dethronement of the fashion-fiend as regards our sex. Thirty years ago we were all obliged to strap down our trousers under our boots, and to wear those abominations called "Wellingtons." Then it was absolutely necessary for a young man to mutilate his face daily with a surgical instrument called a razor. If he did not his moral character was assailed, and all the ordinary avenues for earning a respectable livelihood were closed against him. A City clerk would have been subject to instant dismissal if he wore a moustache; a curate with a beard would have been admonished by the bishop, and rising in the Church was impossible to such a disreputable person. A bearded barrister could not have obtained a brief. Only one British constituency dared to elect a bearded representative, and that was Birmingham. Muntz's beard was a foreboding symbol of the subsequent political career of that terrible town.

Would that I could speak in like terms of the emancipation of woman! Her stays to-day, with the scaffolding of steel and whalebone, are like our stocks of that period, but they are far more mischievous. But I must postpone this subject and that of the moral philosophy of female fashions until my next and concluding paper.

THE BIRTH OF WORLDS.*

THE new star in Andromeda has been popularly regarded as probably a new world. This, whatever else it may be, it assuredly is not. In like manner the new star in the Northern Crown was popularly regarded (by persons unversed in science) as a world in flames. Stars are of course not worlds, whether they be new or temporary or simply variable. The idea gains ground steadily that all so-called new stars—even the glorious orbs seen in remote times, which outshone Sirius in splendour—were but variable stars, with a somewhat exceptional range of variation, and probably of very long period. If the star Mira or Wonderful, in the constellation Cotus, were so situated that when at its faintest it was visible as a third-magnitude star, it would outshine all the stars in the heavens when at its *maximum* of splendour. So would Eta Argûs, and so also would the so-called new star in the Northern Crown. Indeed, if we regard the nebula in Andromeda as lying further away than the faintest star visible to the naked eye, then, were we brought so much nearer that its distance was only that of a first-magnitude star, the *nova stella* (probably but a *stella mutabilis*) which shone out recently in its midst would have been resplendently visible instead of needing a telescope for its detection.

Neither this star, nor any other new variable, or temporary star ever observed, can be said to have thrown the least light on the birth of worlds. Certainly, if the nebular hypothesis of Laplace represents the real way in which solar systems are formed, no new star has thrown light upon that process, or possibly can; for the process imagined by Laplace involved no catastrophes. It was a steadily acting process, rather leaving nebulous rings behind than throwing them off as commonly supposed; the rings separated into parts as they shrank longitudinally by a gentle movement, and the various fragments coalesced rather than collided, for they were all travelling the same way round; in fine, Laplace imagined no fierce conflict of matter with matter such as the sudden outburst of splendour in what we call a new star necessarily implies.

It might be well, however, if the interest excited by the new star, though it may throw no new light on Laplace's hypothesis should direct some degree of attention to the very remarkable defects which any astronomer who knows ought of physics, or any physicist who knows much of astronomy, cannot fail to recognise in that remarkable speculation. Attracted by the effective way in which some features of our solar system, for which the theory of gravitation cannot account appear to be explained by Laplace's hypothesis, many astronomers overlook the startling difficulty which Laplace overleapt at the outset. On the other hand, many physicists are unaware that the hypothesis started from what, with the knowledge of physics obtained since Laplace's time, is seen at once to be an absolute impossibility; they know only that a number of astronomical facts appear to require some such theory; of the details which are also required (but which a physicist at once sees to be quite impossible) they know little.

Let us consider how the theory of Laplace was suggested and what the theory required, premising that if the basis of the theory shall appear to be more than unstable that involves no discredit to Laplace, seeing that in his days certain physical laws which are now among the axioms of science were not even suspected. We may take, as an example of what Laplace could and could not do, that masterpiece of mathematical analysis, his inquiry into the stability of Saturn's ring-system; here the mathematical work was almost perfect, and the conclusion, that the rings must be narrow and eccentrically weighted, was demonstrably right, on the assumed premisses; but these premisses were erroneous. A knowledge of physical laws such as Laplace could not have, but such as many boys in our time have acquired, would have shown Laplace that the rings of Saturn could not be what he assumed them (quite unquestioningly) to be at the very outset of his inquiry. Solid rings on the scale of the Saturnian system could no more remain unbroken under the forces to which they are subjected than a model of the Menai-bridge, perfect in all other respects, but on such a scale as to span 100 miles, could bear its own weight. In this case, where not a theory, but a magnificent calculation of his, was in question, science has not hesitated to set Laplace's conclusions aside, because of the falsity of his assumptions, adopting, instead, the results

* From the *Times*.

which Clerk Maxwell, Pierce, the Bonds and others have established—viz., that the Saturnian rings consist of myriads of tiny satellites, like sands on the sea-shore for multitude. But, strangely enough, in the case of his far-famed (chiefly because so imposing) hypothesis of the birth of worlds, which starts from a similar, or rather from a much more monstrous, mistake (very natural, though, in Laplace's time), science has scarcely even questioned his results, far less examined his initial assumptions.

The facts which the nebular hypothesis of Laplace was intended to explain are simply these:—The planets travel the same way round, and in nearly the same plane (all but the zone of minor planets, whose entire mass is less than the tenth part of our earth's). The central sun turns the same way on his axis, so do all the planets whose rotation has been observed; all the moons travel round their ruling planets the same way—except the moons of Uranus (known, it must be remembered, to Laplace) and the moon of Neptune; and these bodies, travelling as they do at the very outskirts of our system, may be regarded as having, perhaps, been exposed to disturbing influences affecting, in their case, the action of the laws, whatever they were, which gave these features of uniformity to our solar system. Laplace suggested, as a hypothesis which seemed to him to result (*une hypothèse qui me paraît résulter*) from these features, that the whole mass of matter out of which the solar system was formed was once an immense disc, extending beyond the path of the remotest planet now known, and rotating as one gigantic whole. Granting only this assumption, and starting from it, all the features of the solar system mentioned above would follow. The ring would gradually shrink as its heat was radiated into space, until the outer parts, retaining their original velocity, could no longer cohere, but would be left outside in the form of a gigantic ring. This ring, as it further shrank (along its length now), would dissolve into fragments, and these would eventually coalesce into a single planet, the outermost. Then another would be formed in the same way, and another, and yet another, until at last there would be left, in the middle, the great mass which was afterwards to govern that family of worlds. Each planet, at its beginning, being like the original gaseous disc, would go through a similar process of contraction, and form as many bodies subsidiary to itself as its quantity of matter and the conditions under which it had itself been formed would allow. The process would fail in some cases, and so several small planets would be formed instead of one large one, as we see in the case of the asteroids; or, as in the case of Saturn's system, a ring or set of rings (rings of small satellites, as we now know) would form instead of a single large satellite.

Laplace's theory, if we grant its initial assumption, accounts fairly for all the features of the solar system, except the singular distribution of the planets into families—the giant planets outside, as if guarding the rest; the terrestrial planets near the sun, as if under his protecting wing; the asteroids or minor planets in the mid space between these families, as if keeping them apart. But, unfortunately, the initial assumption, on which the whole theory depends, is as utterly inadmissible as the theory that Saturn's rings might conceivably be solid. It is almost inconceivable how amazingly impossible that initial assumption is. Few probably know that a solid disc of steel, extending only to the earth's orbit, could not move as a single mass. If the central part of such a disc—say a region as large as the sun's globe—were set rotating as by some mighty hand, the outer parts would not feel the impulse until more than ten months had elapsed. But imagine a disc extending to the orbit of the planet Neptune, thirty times further from the centre than is the earth's path. Imagine, further, such a disc-shaped region of space, not occupied by a mighty mass of the stoutest steel, but by a vaporous mass many thousands of times more tenuous than the air we breathe. It is such a disc that we have to imagine, according to Laplace's theory, rotating as a single mass. No argument is really needed to show that this is absolutely impossible. But it is a truly remarkable circumstance that, while a mathematician like Clerk Maxwell did not hesitate to point out (with perfect justice, be it remarked) that the solid flat rings which Laplace recognised in the Saturnian system, because they seemed to be plainly visible there, would be absolutely plastic under the forces to which they were exposed, astronomers and physicists have been apparently afraid to acknowledge that a vaporous disc such as he only imagined, a disc rarer than the rarest known gas, so vast that the whole Saturnian system would be but as a speck by comparison, and moved by far mightier forces than act on that system, could have no coherence whatever, and could not possibly even begin to behave as Laplace's theory required. If the mere mathematician had been thus weak, we might not have wondered, for mathematicians often rejoice over problems depending on impossible conditions—perfect rigidity, absolute uniformity, entire absence of friction, and so forth. But physicists and astronomers have usually required conditions more in accordance with the actual workings of nature.

A MAN WHO HAS BEEN SHOT THROUGH THE BRAIN.

By William F. Fluhrer, M.D.*

On the 24th of January, 1884, I was informed by my house surgeon that Bruno Knorr, a healthy young man, nineteen years old, had, on the morning of that day, been admitted into one of my wards at Bellevue Hospital, suffering from a pistol-shot wound penetrating the brain through the centre of the forehead. On my visit at 3 p.m. I found the patient semi-unconscious. When aroused he was irritable, and in answer to all questions grunted "ja." There was complete loss of motion without loss of sensation on the right side of the body below the head. The left side of the body was hyperæsthetic. This increased sensitiveness was very marked upon the left side of the scalp near the ear. The pupils were of equal size and rather widely dilated. His pulse was 100, temperature 101·4°. There was no history of the circumstances of the occurrence of the injury. It has, however, since been learned from the patient that, at about half-past four o'clock on the morning of the day of admission to the hospital, while lying on his back he shot himself with a pistol held in contact with the forehead. Instantaneously he became unconscious, and remained so for about three-quarters of an hour, after which he awoke, and with much difficulty, on account of weakness from loss of

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blood, arose and left the house. He walked about an eighth of a mile, and then got upon a horse-car while in motion and took a seat inside. When called upon by the conductor to explain the nature of his injury, he could not speak, although he knew what he wanted to say. After riding about three-quarters of a mile he was put off the car by the conductor. He distinctly remembered having swung himself from the car with the aid of his right hand. After walking about an eighth of a mile farther, he stood upon the corner of the street till a policeman came and conducted him about one-third of a mile to the station-house. There he was questioned by the officer in command, but was unable to speak. Not long after he became unconscious. He was admitted into the hospital at about 8 a.m., when his wound, from which brain-matter was oozing, was dressed antiseptically.

Preparatory to the operation, the patient's scalp was shaved. He was then etherized. A flap of gutta-percha tissue was fastened to his forehead to protect his eyes from the antiseptic solution of bichloride of mercury, 1 part to 1,000 of water, with which the parts were to be irrigated during the operation. The bullet-hole, of small size, was very nearly in the centre of the forehead. The skin at the right margin of the opening was more ragged than at the left side. The epidermis was blistered off for a little distance from the opening. There were no powder grains in the skin. The soft parts were puffy.

To ascertain the direction of the wound through the soft parts and bone beneath, a silver probe with a large knob was passed into the wound perpendicularly to the surface of the skull. To pass the probe through the opening in the bone I found it necessary to direct its course outward at an angle slightly divergent from the median plane of the head. In passing the probe thus far, the right margin of the opening in the skull was felt to have a depressed shelving-edge. An incision an inch and three-quarters long was then made from below upward to the centre of the bullet-hole. This incision was parallel to the median line, and just to the left of it.

[Here follows an account, occupying three long columns, of the operation for tracing the path of the bullet (which had passed to the back of the skull, and had thence been deflected towards the left), and extracting the bullet when found. The account is full of matter interesting only to surgeons.]

The operation was completed in about four hours from its commencement, the greater portion of the time having been spent in stopping the cerebral hæmorrhage. The following-named members of the house staff were present at the operation: Dr. R. T. Morris, Dr. J. R. Conway, junr., Dr. W. W. French, Dr. J. H. Woodward, Dr. H. N. Williams, Dr. P. Oppenheimer, Dr. H. S. Wildman, Dr. H. Herman, Dr. H Biggs, Dr. E. Hurd, Dr. C. F. Roberts, and Dr. W. G. Rutherford.

The patient's general condition after the operation was about the same as when it was undertaken. He was transferred to the Sturgis Pavilion, special orders being given that he should not be allowed to suffer from retention of urine, and that pain should be relieved by sufficient doses of morphine.

At nine o'clock p.m the patient's temperature was 101° Fahr., his pulse 120, and respiration 32. A hypodermic of Magendie's solution of morphine, seven minims, was given; his urine was drawn by gum-elastic catheter.

January 25.—The patient is in about the same condition as before the operation. He is semi-comatose, still hyperæsthetic upon the left side of the body, and irritable when aroused. He drinks milk with an apparent relish, and puts out his tongue when told to do so.

[From this time onward there was a gradual improvement and final recovery.]

In treating the herniæ cerebri it was my aim to deal gently with them, at the same time keeping the wounds aseptic. In the period of their formation no pressure was made upon the brain protrusions. I looked upon their production as in part due to swelling of the cerebral tissue as a result of its injury, and based my non-interference upon the intolerance to pressure of acutely swollen or inflamed wounded tissues. From this point of view, the openings, of considerable size, in the skull were a benefit in the treatment of the deep brain injury in its early stage rather than a disadvantage. In a later stage, however, when the brain protrusions had reached their greatest size and the course of the wounds had become chronic, I thought it advisable to aid the recession of the hernia by gentle and evenly applied pressure.

On May 22, 1884, I exhibited Knorr at Bellevue Hospital to a number of physicians. He was then, so far as could be judged, in perfect health. Apart from the scars upon the patient, the only abnormality discoverable was a limitation of the visual field for green and red observed by Dr. W. F. Mittendorf. Inasmuch as this feature was common to both eyes, it is questionable whether it was caused by the injury.

The bullet entered at the centre of the forehead, an inch and a quarter above the upper level of the eyebrows; it passed in a straight line through the brain, and was then deflected to its place of lodgment—an inch and a half to the left of the posterior medain line. The probe having been passed through, the straight portion of the wound was eliminated in the further search for the bullet. The probe was then passed through the deflected course after the same method as employed for the exploration of a tortuous wound. The bullet could have been followed about three inches farther upon its deflected course till arrested by the tentorium, the end of the probe being exposed by a second counter-opening in the skull.

The bullet cut upon the superior longitudinal sinus and penetrated the brain in the first frontal convolution, just at the edge of the hemisphere, where the convex surface joins the inner surface; traversing the brain-substance of the hemisphere, it emerged and lodged in the superior parietal convolution. The distance between the two openings in the brain, in a straight line, was six inches and a quarter.

In order to locate the injured cerebral artery with reference to the course of the ball, I carefully marked upon a cadaver the points of entrance and emergence of the bullet. I then removed a section of the skull to enable me to pass a straight-edged, long knife through the brain, in a straight line between these points. Upon removal of the brain, it was found that the cut in the first frontal convolution was down to a large branch of the anterior cerebral artery, lying about half an inch from the surface of the brain.

The patient left the hospital, where he had for a long time been retained simply for observation, on June 30, 1884.

About August 1 the patient went back to work at his old employment in a butcher's shop. He remained at work during the exceptionally hot weather in the early part of September.

On September 12, between twelve and one o'clock in the morning, Knorr received a heavy blow in the anterior

scar from the elbow of the man with whom he was sleeping. Knorr states that he suffered intense pain in the head for half-an-hour, when it died away, and he fell asleep again. He awoke at about four o'clock and noticed, with wonder, his right forearm beginning to flex upon the arm. He tried to hold it down with his left hand, but failed. Then his right leg was drawn up. Then his left upper and lower extremities, respectively, became affected in the same manner. He remembered being asked what was the matter, and that he could not speak, but screamed, and then lost consciousness. The convulsive movements were so energetic that the patient was thrown from his bed upon the floor.

The same day he went to work, but did not feel well. The physician who attended him during my absence from the city prescribed twenty grains of bromide of potassium with fifteen grains of bromide of sodium, in a wineglass of water, every four hours. The medicine acting as a cathartic, Knorr took it rather irregularly, and for ten days prior to Oct. 1 had abstained from its use altogether.

On Oct. 1, while delivering a parcel at the house of a customer, he was seized with a slight rigidity, followed by a short convulsive movement of the limbs and a momentary loss of consciousness, but did not fall. He walked away, and continued to work all that day, but he "felt sick all over." He consulted me upon my arrival home that day. I immediately impressed on him the importance of persistently continuing to take his medicine. I prescribed fifteen grains of bromide of sodium with thirty grains of bromide of potassium, to be taken, largely diluted, every morning and evening.

He soon came under the influence of the medicine, as shown by the eruption of acne and insensibility of the fauces.

He has continued to take the bromide in doses of twenty grains in the morning and thirty grains in the evening, and has had no recurrence of convulsions or other epileptic symptoms whatever for a period of nearly six months. When he began working after his discharge from the hospital he noticed, in trying to keep in mind the orders for deliveries to customers, that his memory was not so good as before the injury. He now follows the same occupation, and performs the same duties in it, as before he was shot. He feels perfectly well, and, by the test mentioned above, is sure that his memory is constantly growing more retentive.

The openings in the skull are closed simply by the soft parts. The posterior scar is depressed about three-eighths of an inch, and pulsates to the touch. The anterior scar, which for a long time was very thin in two spots, is constantly growing firmer. It is depressed one-quarter of an inch, and visibly pulsates. Each scar bulges about one-quarter of an inch above the surrounding surface when that portion of the head is made dependent.

The advisability of extracting from the brain a deeply-lodged projectile follows, necessarily, from the case of Knorr.—*New York Medical Journal.*

BURNHAM BEECHES.—Mr. Francis George Heath has presented to the Queen a copy of the holiday edition of his "Burnham Beeches," which she has been pleased courteously to accept.

ROYAL VICTORIA HALL AND COFFEE TAVERN, WATERLOO-BRIDGE-ROAD.—Mr. Clement Hoey has kindly undertaken the arrangement of a series of ballad concerts for the above hall on Thursdays during the winter. He has secured the assistance of many popular artists, and will give the first concert on Oct. 8. Science lectures will be given each Tuesday in the month: on Oct. 6, by Dr. A. H. Fison, on "Some other Worlds"; that on the 13th by Prof. H. G. Seely, on "Coal."

MYSTERIES AND MORALITIES.

BY EDWARD CLODD.

IX.

THE earliest known version of the *Harrowing of Hell*, the subject of one of the oldest English Mysteries, is preserved among the Harleian MSS. in the British Museum, and was privately printed by Mr. Payne Collier, together with four other sacred plays, in an edition of twenty-five copies—a number which, however, was "found more than equal to the demand, from any interest taken in this important and curious subject."

The Prologue invites all to hearken how Dominus or

> Jesus wes to helle ygan
> Forte vacche (fetch) thenne hys
> Ant bringen hem to Parays.

When Dominus appears, Satan parleys with him on the unfairness of being deprived of what was fairly won, and argues that

> Whoso buyth any thyng
> Hit is hys ant hys offspryng.
> Adam hungry com me to,
> Mourade (homage) dude y hym me do.
> For on appel ich gif hym,
> He is myn ant al hys kinn.

Dominus replies that the apple with which Satan bought Adam's soul was not his to give:

> The appel ant the appel tre
> Bothe were maked thourh me.

Arriving at "helle-gates" Jesus commands that they be opened, and at his voice the porter or "gateward" runs away in fear. Then the gates open, and Satan, apparently unresisting, is bound till "domesday." Adam, Eua (Eve), Habraham, Dauid, Johannes, Moyses, all welcome their delivering Saviour in turn, and the play ends with a prayer for grace

> to libbe ant end,
> In thi service ant to hevene wende.

The Coventry play comprises only six verses, but the York and Towneley, which are so closely parallel as to indicate derivation from a common original—perhaps the Mystery referred to above—run to much greater length, introducing numerous characters. In the first scene, which is laid outside Hell-gate, Jesus declares his intention to unbind the imprisoned souls whom he had ransomed with his blood, and sends a light into the murky darkness that they might know of his coming. Adam and the others make a joyful noise thereat, alarming the demons:

> *I. Diab.* Helpe! Belsebub! to bynde ther boyes,
> Such harrowe was never are herde in helle.
> *II. Diab.* Why rooris thou soo, rebalde? thou royis
> What is be-tidde, canne thou ought telle?

and so forth, till Belsebub calls "Satan oure sire" and the other devils to council. The voice of Jesus is heard without—

> *Attolite portas principes,*
> Oppen vppe ye princes of Paynes sere;
> *Et elevamini eternales*
> Your yendlas gatis that ye haue here;

the trembling fiends discuss who it may be, when at the like summons, *Attolite*, &c., the gates yawn, and Satan, ascending from hell-pit, parleys with Jesus, as in the older version, on the gross injustice of releasing the already damned, and is at last allowed to retain the souls of

murderers, unbelievers, and the like. He chuckles at this, knowing full well how soon he will fill hell again.

> For I schall turne thame tyte I trow,
> I schall walke este and weste
> And garre (make) thame werke wele werre (worse)*

But Jesus calls "Mighill (Michael) myne aungell" to chain the devil in his "selle," and despite Satan's prayer to Mahomet for help he "synkes to helle pitte." Jesus then bids Michael lead Adam and the rest to Paradise, while he returns to the grave "redy to rise vppe-right."

In the Chester play, Satan announces to his "hell-hounds" the intended visit of Jesus, but the distinguishing feature of this pageant is in the conclusion, which was probably added as a satire against vices of the day, notably in this case against the cheating practised by tavern-keepers. A woman who had been in that business addresses Sir Sathanas, sergeant of hell, after Jesus had harrowed it, and tells him how she had defrauded her customers with bad wines and short measure, adding that she will stay and keep him company.†

Mulier.

> Wo be to the tyme when I came heare.
> Wofull am I with thee to dwell,
> Sir Sathanas, sergante of hell;
> Endless paines and sorows cruell
> I suffer in this place.
> Some tyme I was a taverner,
> A gentil gossippe and a tapstere;
> Of wyne and ale a trustie brewer,
> Which wo hath me wroughte;
> Of cannes I kept no treue measuer,
> My cuppes I soulde at my pleasauer
> Deceavinge manye a creature.
> With hoppes I made my ale stronge,
> Ashes and erbs I blend amonge,
> And marred so good maulte;
> Therefore I may my handes wringe,
> Shake my cannes and cuppes ringe;
> Sorrowful may I siche and sing
> That ever I so dealt.

Sathanas.

> Welcome, deare darlinge, to us all three
> Though Jesus be gone with our meanye (company),
> Yet shall thou abyde heare still with me
> In paine without ende.

According to old legend, Enoch and Eli were the sole occupants of Paradise, and in ancient paintings and tapestries representing that abode these two only were depicted. In the early English poem on the "Land of Cockayne" the writer jeers at the solitude of Paradise, and at the dull and sorrowful life its two tenants must lead:—

> Beth ther no men bot two
> Hely and Enok also:
> Elinglish mai hi go,
> Whar ther wromith men no mo.

Satan, the prominent character and butt of the pageants on the victory of Jesus over hell, wore a vizor made of painted buckram,‡ with an enormous mouth, staring eyes, large nose, and red beard. His dress was of leather trimmed with feathers or horsehair, the feet and hands being cloven or clawed, and the traditional tail appended. In some of the later Mysteries, but more frequently in the Moralities, for he is an indispensable element in both, Satan is accompanied by a sort of buffoon or parasite called the Vice, who represented different abstract but always bad qualities, as Hypocrisy, Infidelity, Gluttony, &c., and who is probably the original of the domestic fool or jester attached to palaces and houses of the great. "It was a pretty part in the old church-playes when the nimble Vice would skip up nimbly, like a Jack-anapes, into the Devil's necke, and ride the devil a course, and belabour him with his wooden-dagger till he made him roar, whereat the people would laugh to see the Devil so Vice-haunted."*

Several pictures of hell-mouth, contemporary with the performances of the Mysteries, are given by Mr. Sharp, and there is no doubt, both from the nature of the subject and from the numerous entries of expenditure in the guild records concerning it, that it was a feature of the scenery upon which neither pains nor cost were spared. Speaking generally, it was constructed as a huge monster's head, dragon-like in shape, with glaring red eyeballs and with open jaws, sometimes worked by a windlass,† and disclosing a murky cavern with actual fire therein,‡ or with flames indicated by red paint or buckram, and filled with a great company of devils tormenting the damned, from whom fearful shrieks and groans arose.

> "An hideous hole all vaste, withouten shape,
> Of endlesse depth, orewhelmed with ragged stone,
> With ougly mouth and grizzly iawes doth gape,
> And to our sight confounds itselfe in one." §

DUAL BRAIN BUT SINGLE MIND.‖

By Victor Horsley.

UNFORTUNATELY I had no opportunity before yesterday of seeing the criticisms which you have done me the honour of publishing on the lecture which I recently delivered on the "Will and the Duality of the Brain." I hope, however, that, although somewhat late, you will permit me, by amplifying a few points (necessarily only briefly referred to in my lecture), to offer a fuller explanation of them, and so to show that my views of psychical processes were based on sound experimental evidence, and not on that derived from subjective introspection, &c.

By way of preface, let me point out that while you very correctly report me as objecting to the old theory of the duality of the *mind*, you unintentionally misrepresent me as "finding nothing to support" the duality of the *brain*. For I showed in my lecture that that portion of one half of the brain which governs the movements of a limb was independent of the correspond-

* In the Towneley variant, Satan asks Jesus, if he persists in taking "theym alle me fro" to let him out also: "I pray the leyfe me not behynde."

† An old French poem makes one Richart, when about to be hanged, offer a prayer, in which it is said that Jesus brought back all the souls out of hell except one woman, who would stop at the door to give hell a piece of her mind, and who was, therefore, doomed to stay there till Doomsday.—Grimm's *Teut. Mythol.*, 803.

‡ A.D. 1451. Item. Payd for peynttyng of the demon's hede.
Item. Payd for the demon's gm̃ent makyng and the stof. vs. iijd. Sharp's *Dissertation*, p. 16.

* Harsenet's *Declaration of Popish Impostures*, 4to, 1603. Sharp, p. 58.

† A.D. 1537. Item. payd for kepynge the wynde, vid.
1557. Item. payd for mendynge the wynde.

‡ Item payd for kepynge of fyer at hell mouthe iiijd. That an earthquake was imitated (although the apparatus used is unknown), probably in the pageants of Hell's Harrowing and Doomsday, is shown by the following entries: 1556. Item. payd for the baryll for the yerthequake. Item. payd for kepynge (attending) the baryll.

§ *Mirrour for Magistrates*, quoted in Hone's *Anct. Myst.*, p. 218.

‖ I have to thank Dr. Horsley for his very interesting communication. He is quite right in considering that I had formed inexact ideas as to his meaning; which is indeed very nearly that for which I was contending. I had followed an imperfect report in *Nature*.—R. P.

ing portion in the opposite half or hemisphere; in fact, that structurally, and in part functionally, the excito-motor areas should be regarded as dual. I then showed that duality of mental function in the highest sense, *i.e.*, the simultaneous correct performance of two totally different voluntary acts, was impossible provided that such correct performance necessitated the concentration of the attention on each subject.

You quote the case of Prof. Morse, who "could draw simultaneously . . . . . two different objects with either hand," as invalidating my argument, since such an act would suggest the possibility of the two (highest) cortical-motor areas functionalising at once. Now a good many people, myself included, can perform this feat; but in every instance where I have carefully examined the performance I find that the two pictures are not drawn "simultaneously," in the strictly accurate language of scientific experiment—that there is always a fraction of a second's interval in time between the movements of the hands when these differ at all. We know, further, that ·2 of a second is sufficient interval of time to allow of alternation in the efferent discharge from the two halves of the brain, while I need scarcely add that the ordinary bystander does not appreciate so small an interval of time. As you say truly, it is possible to practise synchronism in actions, and the old schoolboy trick of slapping horizontally the chest with one hand while the other is rubbed up and down is a familiar example of the fact; but this very word "practice" introduces us at once into an absolutely different field of phenomena to those I dealt with in my lecture. It means that an action, at first voluntary, becomes automatic, or, as we should more correctly say, it belongs to a lower grade of simpler, because more often repeated, reflex actions in which the attention is scarcely, if at all, required for their correct performance.

My experiments and statements refer solely to the investigation of purely voluntary phenomena, in which the attention had to be fully concentrated on each problem that was brought before it.

I found, as the result of a large number of experiments (some hundreds) performed by other people as well as myself, that two such efforts of volition could not be performed correctly at absolutely the same moment of time, and the test I used I myself, even after long-continued attempts, never succeeded in overcoming by "practice." May I here remark, that unless Professor Morse was started by a signal, and drew some simple geometrical figures, such as my circle and triangle, his feat scarcely comes within the domain of exact scientific experiment.

Further, you say that we "do not know that when we are trying to do simultaneously two different things, the two different sides of the brain are called into action." Permit me to say on this point that we actually do know (from clinical evidence, some of which I quoted in my lecture) that the *two* halves of the brain are engaged in such actions as my experiment involves, and we now know the parts concerned as well as we do the machinery of the circulation of the blood.

Passing from this part of your article to the question of the evidence we derive from our visual apparatus, I am afraid I scarcely follow you in your remarks about "working the eyes" as analogous to working our hands, for we have, of course, absolutely no voluntary power over our eyes (*e.g.*, in focussing them, &c.). But if I understand you rightly, you would further seek to show that *your* mind must be dual, because it gets simultaneously two different messages from your eyes, owing to their focal distances being different.* This very fact of people seeing perfectly well with one defective eye for so many years without discovering any difference is a fact strongly in support of *my* views, for it is well known that the (single) mind ignores the false evidence from the defective eye. The "double vision," as you call it, of every person is a splendid example of the unity of *function* in the nervous system while the apparatus is duplex in structure. We normally only get one idea from our two eyes—we cannot concentrate our gaze on two objects at once, however hard we try, consequently the attention is never concerned with more than one thing at a time. Further, we now know (from clinical evidence) that, although there is a sight centre in each half of the brain, each is educated simply as its fellow, and therefore if one is destroyed the person knows what he sees just as well as before, showing clearly that although the apparatus is double its function is single. The case of Prof. Ball similarly shows clearly that the brain is dual, that under certain circumstances of disease one sensory perceptive area may be irritated, the other remaining at rest. Such a patient will, therefore, imagine he hears voices talking to him, and he will answer and act accordingly, but the conversation, &c., is alternate—there is no double mental action here, any more than when two persons talk alternately to one another.

I greatly regret that the necessities of a lecture prevented my elaborating my argument, or, perhaps, you would have seen that I am really in perfect agreement with yourself in regarding the brain as a dual machine, my only contention being that in *a purely voluntary act* its function is single.

SURGERY FOR PIANOFORTE PLAYERS.

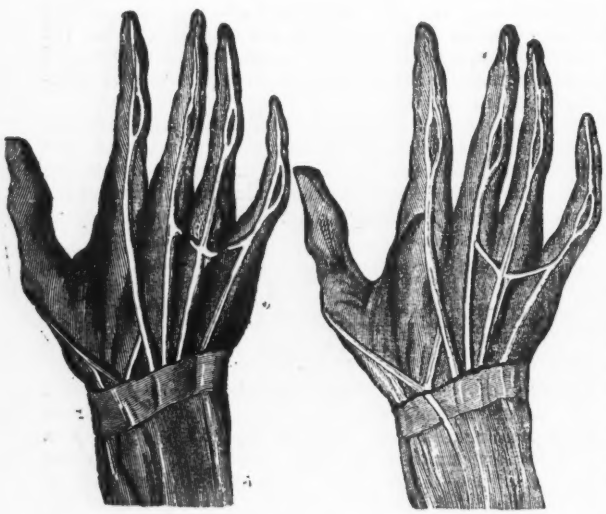
THE most earnest advocates admit that evolution is an extremely slow process: that it produces wonderful results, but that its operations occupy a corresponding amount of time. Certain it is, that the process is not keeping pace with the requirements of modern times, and that the artificial development of the human faculties has of late taken precedence over the natural results of time.

Helmholtz, after making an exhaustive study of the human eye, declared that should he receive an optical instrument of man's making which contained so many defects as the eye, he should be justified in returning it to the manufacturers. But it is these very defects which have stimulated man's ingenuity to find a remedy. So completely has the science of optics come to his assistance that, with the help of the lens in microscope and telescope, he is possessed of an organ capable at once of studying the infinitesimal world represented by a drop of water, or of penetrating the immensity of a solar system. Yet no progress, except, perhaps, in the power of discrimination, is being made with the living instrument, for the eye of the present school-child is probably much inferior in strength and capacity to that of his pioneer grandfather at an equal age.

In other directions, however, man may be improving. His hands, from their constant use of sensitive instru-

* Not quite this. I used double vision only as an *illustration* of brain action; not as an example of it. I certainly did not suppose it was a different *mind* which recognised the imperfect images given by the shortsighted eye.—R. P.

ments and their employment in painstaking investigations, have probably gained a nicety and delicacy of touch which were quite unknown to earlier generations. But even here the progress has not been sufficient to satisfy his wants, and the anatomy of the hand is undergoing a number of modifications due to special treatment or to surgical science. The delicate manipulations of the chemist and physicist or the effective touch of the artist are by no means natural; they result only from the most careful training. In music, whether in using the keys of an instrument, or in working the strings directly, as in the zither or harp, every student remembers the weary practice which has gained him his present proficiency. No amount of devotion, however, seems to have succeeded in overcoming the obstinate weakness of the third or ring finger. Innumerable exercises and daily fingering of the keyboard have left that member but slightly stronger at the end than in the beginning. When, for instance, the middle and little finger are pressed upon the keys to produce a continuous sound, it is almost impossible to bring the ring finger into intermittent



use with a strength sufficient to produce any equality in the tones. The reason is very simple, but rather curious. The *Extensor communis Digitorum* muscle, which moves the ring finger, is connected by lateral or accessory tendons with the muscles of the neighbouring digits, and when these are held down, the accessory tendons prevent the free action of the muscular fibres of the third finger, and hence the clumsy result. These accessory tendons are sometimes found in both hands, often only in one, which in this case is usually the right hand.

Occasionally, the extensor muscle of the ring finger splits at the point of departure of the accessory tendons, and when reunited leaves a button-hole appearance, and now and then these tendons are entirely absent. The possibility of removing this restriction in the use of the ring finger by dividing the accessory tendons suggested itself many years ago, but it is only of late years that the operation has become at all common. Dr. Forbes, the Demonstrator of Anatomy at Jefferson College, and Mr. Zeckwar, the Director of the Philadelphia Musical Academy, have both been much interested in the subject, and have done much to make the operation popular.* By this division of the accessory tendons, the liberation of the ring finger was complete. After such an operation, which is often performed on both hands at one sitting, and without the loss of perhaps more than half a drachm of blood, the finger could be elevated an inch higher above the plane of the hand, and could be used with delightful freedom. There was an entire absence of the sense of exertion which was formerly so painful. Out of fourteen operations which have been performed by Dr. Forbes, all were entirely successful, and in none did any unpleasant results follow. Nor is this resulting liberty at the expense of power in any other direction. The operation does not decrease in the least the ordinary functions of the extensor muscle. Since it can be performed by a surgeon of any competence, it promises in time to become a part of every conservatory course.

As the downwardly projecting point on the helix of the ear is considered by evolutionists to be the remnant of a once-pointed ear, so it is not unreasonable to suspect that the unnecessary tendon may be the last traces of a former webbed formation of hand and foot. That its occurrence is not constant is an undoubted proof of its rudimentary nature. It is quite possible that future students of music will hear with wonder of a binding tendon quite unknown in their own experience.—*Scientific American.*

RAMBLES WITH A HAMMER.

By W. Jerome Harrison, F.G.S.

HUNSTANTON AND THE RED CHALK.

(*Continued from p.* 221.)

BUT the great geological attraction of Hunstanton is the bed of *red chalk* which comes between the lower greensand and the great mass of white chalk above. It is only four ft. thick, but its colour makes it very conspicuous. The colouring matter is peroxide of iron, of which about 6 per cent. is present. Fossils are very numerous, including small *belemnites*, brachiopod shells, and *ammonites*. *Belemnites minimus*—which looks like a tiny lead-pencil—is very common.

The so-called fossil sponge—a branching body resembling the finger of a glove—has been recently shown by Dr. Hinde not to be organic at all, being probably the filled-up burrow of some ancient species of marine worm.

Above this red band we see in the cliff about 40 feet of *white chalk*. As all the strata have a gentle dip to the north-east, we can, by walking along the base of the cliff, examine with convenience a considerable thickness of the rocks. The chalk resting immediately on the red bed is of a cream colour, and is full of the so-called sponge branches; above this is a grey stratum containing many fragments of the shell *Inoceramus;* all higher is the ordinary white chalk. The red chalk can be traced southwards to Snettisham, where it is exposed in one of the great Carstone pits, but further south all traces of it are lost. The keeper of the lighthouse at Hunstanton spends his spare time in extracting the fossils of the rock, and good specimens can usually be obtained from him.

In a northerly direction this red chalk can be traced along the western foot of the Lincolnshire Wolds to Speeton Cliff—six miles north of Flamborough Head—

* The illustrations show respectively the muscular system of the right hand in its natural condition and after the operation has been performed.

in Yorkshire. The exact geological age of the red chalk has been a matter of much dispute. Two geological formations which elsewhere intervene between the chalk and the lower greensand—viz., the upper greensand and the gault—are wanting at, and north of, Hunstanton, and it has been strongly argued that the red chalk is the representative of the gault. The most recent researches, however, go to prove that this unique bed is what it appears to be—the true local base of the chalk; its fossils belonging in greater numbers to species found in the chalk above than to those which characterise the gault elsewhere, though many of the species are common to both these formations. The ordinary white chalk will be seen (*vide* Map, *ante*, p. 221) to form all the country to the east, and Hunstanton is supplied with water from springs in this rock.

Lastly—and of comparatively recent geological age—we come to the marshy beds which cover the older rocks and form a strip along the shore, extending inland from a quarter of a mile to two miles. We can trace them from the railway station southwards to Heacham station, Wolverton, and beyond. In the large pit at the gasworks a thick bed of sand and shingle is worked, which contains numerous marine shells of species still existing, showing that the deposit is one of late geological age. On the fore-shore, a "submerged forest" may be detected when the tide is at its lowest; it is probably an extension of a peat-bed which once had a much larger area. At the southern end of Hunstanton cliff, a thin mass of reddish boulder clay rests on the white chalk; and in Hunstanton Park is a winding ridge of gravel and sand, evidently identical with the deposits called "kames" in Scotland and "eskers" in Ireland. The vertical relations of all the strata are shown in Fig. 2, from the oldest—the Kimeridge clay at the base—to the newest—the beds of boulder-clay and alluvium which lie indiscriminately on the upturned edges of any or all of the "solid" rocks.

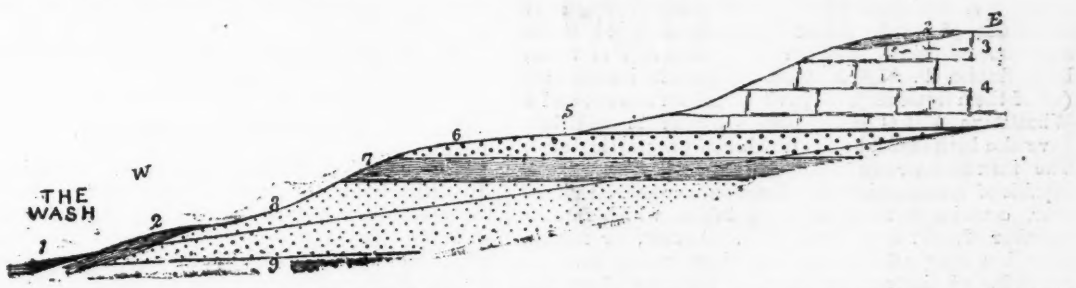


Fig. 2.—Diagram-section of the country south of Hunstanton.—1. Alluvium. 2. Boulder clay 3. Chalk with flints. 4. Hard chalk without flints. 5. Red chalk (thin). 6. Carstone, lower greensand. 7. Clay and loam, lower greensand. 8. Sand, lower greensand. 9. Probable position of Kimeridge clay.

Thus, at Hunstanton, we have first the "solid" geology exemplified by the strata from the *lower greensand* to the *chalk*, and then the "superficial" geology of the surface deposits of boulder clay, gravel, &c. Between the deposit of these two sets of rocks an enormous interval of time elapsed, during which strata, many thousands of feet in thickness, were deposited in other localities. Those who visit Hunstanton will find bracing air and a rolling sea; if they desire a pleasant occupation for their leisure hours, let them turn to the rocks, study their nature, and collect their fossils.

THE death-rate of London declined last week to 13·8 per thousand annually, which is stated by the Registrar-General to be considerably lower than in any other week since the publication of the official returns.

THE NEW TELEGRAPH TARIFF.

By W. Slingo.

AS, I suppose, every one is aware, yesterday witnessed the introduction of the reduced tariff, as sanctioned by the Telegraph Acts Amendment Bill, which passed both Houses of Parliament last session. It is out of the question to discuss yet the actual effect, either upon the public or the telegraph department, these lines being written some few hours prior to the application of the scheme. There are, however, many features in the preparations which have been made in the anticipation of an increase of thirty per cent. in the amount of work performed that are worthy of attention. It is, as a rule, one of the standing tenets in the management of a Government department, as opposed to a private undertaking, not to anticipate, but only to provide for exigencies as they arise. In a case like the one under consideration, however, such tenets have to be cast on one side, and a broader and more commercial view of matters taken and adopted. There is one danger which beyond and above all others must be avoided, and that is the risk of providing insufficient accommodation. As matters stand, everything is speculation, and there is little warrant for the assumption that there will be immediately an extensive increase in the number of persons using the telegraph. However, the scheme as promulgated and passed by Parliament has received such a considerable amount of attention at the hands of the daily press, that there is little call to enlarge here upon this phase of the subject. Nor could much good result from it, seeing that everything is determined upon and is for the present unalterable. The preparations which have been made to cope with the expected increase are on a most gigantic scale—much more so than would at first sight appear from the amount of money which has been expended, or from the increased expenditure which it is surmised will in the future be incurred. The cost of these preparations so far has been but little over half a million of money, a sum which, expended by the Board of Works, the War Office, or any kindred "spending" department would be regarded as of most insignificant dimensions. The greater portion, too, of this money, notwithstanding the high price which has to be paid for the more or less elaborate instruments and other appliances employed, has been sunk in the purchase and erection of wires and poles. It will be apparent that many thousand miles of wire and many hundred poles have to be erected before any considerable expenditure is involved.

A very fair idea of what has been done throughout the

country may be gathered from a consideration of the changes and extensions pertaining to the Central Office. The spring of last year saw the commencement of the preparations, and at that time the instrument room located on the third floor of the new post office building in St. Martin's-le-Grand contained 720 sets of apparatus, working 685 wires or circuits. These communicated with 230 provincial towns and 424 offices in the metropolitan district. In addition to these there were 49 pneumatic tubes working between the Central Office and several of the adjacent busy offices. The sets of apparatus included 160 single-needle instruments, 425 Morse sounder and printing instruments (of which 188 were worked on the duplex system), 80 sets of Wheatstone automatic fast speed apparatus (these also including 27 on the duplex system), 16 sets of quadruplex apparatus (sending two messages each way simultaneously upon a single wire), and 4 Wheatstone A B C instruments. To work these a staff of 1,730 clerks was employed at various hours of the day and night, the tubes being worked by a staff of 34 attendants.

Within the past eighteen months 172 new wires have been erected, 48 of them being single-needle circuits, 122 Morse sounder or printer circuits, and 2 Wheatstone automatic circuits; 95 provincial towns and 77 metropolitan offices are involved in these extensions. Besides these, many existing circuits have been duplexed, or their carrying capacity in some other way increased; so that at the present time there are altogether 908 sets of apparatus, of which 151 are single-needles, 591 Morse sounders and printers (307, or more than half of them, being duplexed), 57 Wheatstone automatic instruments (all of them duplexed), 18 quadruplex instruments, and 4 Wheatstone A B C instruments. Numerous additions have also been made to the number of pneumatic tubes. The instrument-room as it existed last year was incapable of accommodating so large an increase. It, however, contains a series of long tables, which furnish together 2,885 ft. of desk-space. A new, or fourth, floor has been added, and its single room contains 1,400 ft. of instrument-tables, which are burdened already with 468 sets of apparatus working to the offices in the metropolitan district. The staff has been largely increased, and at the present time numbers nearly two thousand.

The large central hall, on the ground floor of the building, has been appropriated for the pneumatic tubes, the removal of which from the instrument-room increases the possible accommodation there very considerably.

The new wires which have been erected have been, in the main, carried along the high roads, comparatively few extensions having been made on the various railway routes. "Road" wires now span the country in all directions, the recent additions including eighteen wires to the north, pursuing a path known as the east coast route, through Biggleswade, Baldock, Peterborough, Doncaster, Newcastle, &c. One of these wires working to Newcastle is of hard-drawn copper, the cost of which, on account of its thinness, is about the same as that of an iron wire, while the working capacity is considerably higher. Mr. Preece, in a paper read at the recent meeting of the British Association, ventured the opinion that copper responds more readily to rapid changes of electric currents than iron. He suggested that the magnetic susceptibility of the iron is the cause of this, the magnetism of the iron acting as a kind of drag on the currents. The paragraph in last week's "Miscellanea" reveals that the copper wire is capable of transmitting 414 words in a minute, while an iron wire can only carry 345 words.

A second system to the north, known as the west coast route, is also furnished with eighteen wires, the road passing through Aylesbury, Weedon, Stafford, Nantwich, Preston, &c.

Twenty wires now leave London by what is called the Bristol Road Line, passing through Slough, Reading, Marlborough, Chippenham, and Bristol, and thence on to South Wales and the West of England.

Another system leaves London by the South Western Railway, passing along the line to Salisbury, where it "takes the road," and supplies Exeter, Plymouth, Penzance, The Channel Islands, &c. Similar but smaller extensions have been made in the South and South-Eastern divisions, but it is characteristic of the telegraph wires that they all pass through London in underground pipes. Some of them are carried as far as Barnet, others beyond Uxbridge, and others to Hounslow before they "take the open." Such are a few of the details concerning the Central Office, and similar work has been involved elsewhere, altogether, upwards of 20,000 miles of wires having been added to those already existing. It remains to be seen whether the anticipation of an increase of thirty per cent. on the number of messages (24,000,000) annually transmitted will be realised or exceeded.

HUMAN REMAINS FOUND NEAR MEXICO.

By Mariano de la Barcena.

In the month of January, 1884, some excavations were being made, by means of dynamite, at the foot of the small hill known as "*Peñon de los Baños*," some four kilomètres east of the City of Mexico. The excavations were made with the object of quarrying building stone for the Military Shooting School, which is being constructed near the Peñon and under the supervision of Colonel Don Adolfo Obregon. This gentleman, at the beginning of January, was informed that among the rocks loosened by the dynamite some bones were to be found, and he accordingly collected and delivered them to the Minister of Public Works, Don Carlos Pacheco, who appointed the writer to make a study of them. The preliminary examination being made, I presented them to the Mexican Society of Natural History, giving at the same time public notice of so important a discovery.

Some days afterwards I explored the formation in which the bones were found, continuing my studies with the co-operation of Don Antonio del Castillo, professor of geology, whom I invited to take part in my investigations; both making up a report which has lately been published in Mexico.

The human remains are firmly imbedded in a rock formed of silicified calcareous tufa, very hard and of a brownish-grey colour. The cranium, with the lower and upper maxillæ and fragments of the collar-bone, vertebræ, ribs and bones from the upper and lower limbs are exposed. The bones lie in disorder, proving that the rock in which the skeleton was found suffered an upheaval before consolidation, a circumstance which an examination of the ground further verifies. The bones present a yellowish appearance, and the characteristic aspects of fossilisation, it being noteworthy that

they are not coated with layers of the calcareous rock as is observed in the recent deposits, but are firmly imbedded in the stone, which also fills the cells of the tissue.

Several distinct formations and rocks are seen in the locality where the bones were found; towards the centre rises the small hill, "*del Penon*," consisting of volcanic porphyries; on the base to the north there appear first a clearly recent formation made up of vegetable earth, marl, and ceramical remains, which in the upper part are modern, and in the lower belong to the Aztec ceramics. Under this recent formation are the calcareous layers in which the human remains were found.

These layers crop out with a rise toward the northern boundary, forming the end of an esplanade which surrounds the hill, and is three mètres above the actual level of the waters of Lake Tezcoco. The layer of hardened rock does not extend with regularity the whole distance from the before-mentioned edge to the foot of the hill, some intervening spaces occurring in which this rock does not appear, the resulting hollows being filled with recent ground. This circumstance, as well as the appearance of the layers of calcareous tufa, prove that this rock was upheaved after the deposit of the human bones, by the igneous rocks which crop out in the neighbourhood of the hill, forming dykes. This upheaval is also verified by the numerous small veins which are found in different directions on the ground.

In order to clearly establish the age which the deposit of the human bones might have, the best scientific method would be to find some animal fossil remains in the same formation which would distinctly mark the age of the layers of that calcareous rock; but until now, notwithstanding the many searches made, it has not yet been possible to find any traces of extinct animals; neither has there been found any vestige of ceramics or other remains that might indicate that these rocks were clearly modern, as among them the only things found were the human bones, roots converted into menilite, and some small indeterminable lacustrine shells formed by the same calcareous substance. These shells belong to genera which have lived in Quaternary as well as present waters, it having been impossible to determine their species on account of the bad state of preservation in which they were found.

In the region to the south of the hill more modern calcareous rocks are seen, and thicker deposits of recent ground with remains of Aztec ceramics.

Not being, therefore, able to utilise the palæontological data for determining the age of these calcareous layers, we must fall back on the inspection of the ground.

Two facts seem at once to reveal that, even supposing the formation to belong to the present age, it must be of remote antiquity. These facts are: the elevation of the ground above the actual level of the Lake of Tezcoco, and the remarkable hardness of the rock in which the bones are found, different from the other calcareous rocks that contain remains of ceramics or roots of plants clearly modern. The upheaval of the lacustrine layers which contain the human remains might have taken place through the diminution and retirement of the waters of the lake, or by the upheaval of volcanic rocks.

In the first case it could have been occasioned either by a violent filtration of the water, or a slow evaporation; but nowhere in the valley of Mexico are any traces to be found of a crack or opening through which the waters could have escaped, and which ought to appear outside of the present level of the lake, as, if it were below, all the water would have disappeared. If the lowering of level was due to evaporation, a theory which would be more admissible, because from the time of the conquest of Mexico to the present the submerged surfaces have notably diminished, the time necessary to have elapsed in order that the level of the lake might fall three mètres to its present one must have been very long. What is most probable is, that the upheaval is due to volcanic action; for, although until now no basalt has been discovered immediately underneath the place occupied by the hardened layers, yet dykes of that rock are to be seen in different directions at the foot of the hill, and even the volcanic masses which constitute it are found upheaved and inclined, demonstrating the succession of geological phenomena in that vicinity.

Let us now trace the origin of the silicified calcareous rock in which the bones were found, and which is different from the majority of the lacustrine rocks which occupy the valley of Mexico, these latter being, for the most part, thick and extensive layers of pumice, tufas, marls, volcanic ashes, clays, and alluvions.

In order to proceed with more certainty in this investigation, I compared the calcareous rock in question with those which resembled it most from other parts of Mexico, and found it could only be considered similar to those which are clearly of a hydrothermal origin.

The hot-water spring which exists in the eastern part of the hill del Peñon forms sediments somewhat similar to the silicified calcareous tufa; but these are on a small scale, and their formation is so slow as to preclude the belief that this spring could have filled all the immediate surroundings of the hill with deposits of such magnitude. What is most probable is, that in remote times there were great emissions of mineral thermal waters through different fissures, and in several directions, whose appearance was simultaneous with the basaltic masses that form dykes at the foot of the hill, as in the faces of the rocks sedimentations similar to the referred ones are perceived, there being, furthermore, many small veins which cut through the basaltic masses and even the calcareous rock.

By this it is seen that a series of vocanic phenomena must have taken place in that spot, beginning before the human remains were deposited, and which further continued when the material which received them was but little consolidated.

The succession of these phenomena took place, without doubt, in the following way:—

1. Emission of thermal waters and appearance of basaltic rocks, upheaving the masses that formed the hill. These waters mixed with those of the lake which surrounded the hill and extended over a large area of the valley of Mexico; the calcareous deposits gradually accumulated around the hill, and being still soft the human corpse was deposited upon them.

2. When the bones were already imbedded in the lacustrine deposit there came a new volcanic upheaval which raised this deposit, as the higher level which it now occupies proves, and the disorder in which the bones of the skeleton appear.

3. In the gaps which were left after this upheaval, modern lacustrine deposits were formed, which increase even at the present time.

It is to be remarked that in other parts of the valley of Mexico in connection with the Lake of Tezcoco, isolated deposits of this silicified calcareous rock are seen, showing that the volcanic upheaval extended over a large surface, and that the thermal waters appeared several times. One of these deposits is to be found at the height of two mètres above the present ground among rocks of the hill del Tepeyac, north of the City of Mexico.

The geological circumstances of the event once determined, and notwithstanding that the palæontological data are wanting that might mark with precision the relative age of that deposit, it is to be believed that it must be of remote antiquity, considering the circumstances which the mentioned rocks present, as well as the geological phenomena which have there taken place and of which no notice is given in the hieroglyphics or traditions of the ancient Mexicans.

This consideration alone is enough to believe that the man of the Peñon is pre-historic. The odontological characteristics indicate that this man belonged to an unmixed race, the teeth being set with regularity and corresponding perfectly the upper with the lower. They present the peculiarity besides, that the canine teeth are not conical, but have the same shape as the incisors; a peculiarity which has been observed in other teeth found in very ancient graves of the Toltecs.

The size and shape of the bones of the limbs are those corresponding to a man of ordinary stature, and from the appearance of the teeth the man must have been about forty years old.

The greater part of the cranium having been destroyed, it was not possible to determine its diameters and thus classify it. The stratigraphical and lithological characteristics of the ground seem to indicate that the formation belongs to the upper Quaternary, or at least to the base of the present geological age.

It may as well be remarked that at the foot of the steep slope of the Tepeyac hill, near the place where the calcareous sediments are to be seen among the rocks of the hill, as was previously mentioned, some excavations were made, and Professor Don Antonio del Castillo found various bones of Quaternary animals enveloped in a calcareous rock similar to that of the Peñon. The distance between this hill and the Tepeyac is nearly three miles.

The excavations continue at the foot of the hill del Peñon, with the object of quarrying building stone, and this will allow in the course of time some other data to be discovered which will clearly mark the geological age of the event; a tooth of a mastodon or an object of the present age would at once be the landmark assigning it a fixed page in the history of the earth. The authenticity of the fossil is not only determined by the report of Señor Obregon and the identity of the rock which contains the remains with the blocks that are being at present quarried at the foot of the hill, but I, myself, have determined this authenticity, having found part of the human remains still imbedded in the ground rock.

I will conclude by mentioning other facts that indicate the antiquity of man in the valley of Mexico. Twelve years ago, in executing some works for the drainage of the valley, in the direction of Tequisquiac, numerous deposits were discovered belonging to Quaternary animals, such as elephants, mastodons, glyptodons, &c., and among one of these deposits a fossil bone was found carved by human hand and imitating an animal's head. Unfortunately no care was taken to determine if it was found simultaneously with the bones of the Quaternary animals. The appearance of the carved bone, and of the cuts and incisions which it has, denote a remarkable antiquity, and it has characteristics of fossilisation. Two years ago I discovered some remains of ancient ceramics in the pumice tufa which is under the basaltic lava formation found in the south-eastern part of the valley of Mexico; the lava occupies a large area, and in some points its thickness is over two mètres. No tradition makes any mention of this volcanic cataclysm before the existence of man in the valley of Mexico.

These are, at present, all the data I can give relative to the man del Peñon. On my return to Mexico I will continue with a further investigation of the ground where the discovery was made, and will communicate anything new that may be found, in order to determine the anthropological importance which these human remains may have.

FIRST STAR LESSONS.

By Richard A. Proctor.

THE constellations included in the twenty-four maps of this series are numbered throughout as follows (the names being omitted on the maps, to clear these as far as possible from all that might render the star-grouping less distinct):—

1. *Ursa Minor*, the *Little Bear* (*a*, the *Pole Star*).
2. *Draco*, the *Dragon* (*a*, *Thuban*)
3. *Cepheus*, *King Cepheus*.
4. *Cassiopeia*, the *Lady in the Chair*.
5. *Perseus*, the *Champion* (*β*, *Algol*, famous variable).
6. *Auriga*, the *Charioteer* (*a*, *Capella*)
7. *Ursa Major*, the *Greater Bear* (*a*, *β*, the *Pointers*).
8. *Canes Venatici*, the *Hunting Dogs* (*a*, *Cor Caroli*).
9. *Coma Berenices*, *Queen Berenice's Hair*.
10. *Boötes*, the *Herdsman* (*a*, *Arcturus*).
11. *Corona Borealis*, the *Northern Crown*.
12. *Serpens*, the *Serpent*.
13. *Hercules*, the *Kneeler*.
14. *Lyra*, the *Lyre* (*a*, *Vega*).
15. *Cygnus*, the *Swan* (*a*, *Arided*; *β*, *Albireo*).
16. *Pegasus*, the *Winged Horse*.
17. *Andromeda*, the *Chained Lady*.
18. *Triangula*, the *Triangles*.
19. *Aries*, the *Ram*.
20. *Taurus*, the *Bull* (*a*, *Aldeburan*; *η*, *Alcyone*, chief *Pleiad*).
21. *Gemini*, the *Twins* (*a*, *Castor*; *β*, *Pollux*).
22. *Cancer*, the *Crab* (the cluster is the *Beehive*).
23. *Leo*, the *Lion* (*a*, *Regulus*).
24. *Virgo*, the *Virgin* (*a*, *Spica*).
25. *Libra*, the *Scales*.
26. *Ophiuchus*, the *Serpent Holder*.
27. *Aquila*, the *Eagle* (*a*, *Altair*).
28. *Delphinus*, the *Dolphin*.
29. *Aquarius*, the *Water Carrier*.
30. *Pisces*, the *Fishes*.
31. *Cetus*, the *Sea Monster* (*o*, *Mira*, remarkable variable).
32. *Eridanus*, the *River*.
33. *Orion*, the *Giant Hunter* (*a*, *Betelgeux*; *β*, *Rigel*).
34. *Canis Minor*, the *Lesser Dog* (*a*, *Procyon*).
35. *Hydra*, the *Sea Serpent* (*a*, *Alphard*).
36. *Crater*, the *Cup* (*a*, *Alkes*).
37. *Corvus*, the *Crow*.
38. *Scorpio*, the *Scorpion* (*a*, *Antares*).
39. *Sagittarius*, the *Archer*.
40. *Capricornus*, the *Sea Goat*.
41. *Piscis Australis*, the *Southern Fish* (*a*, *Fomalhaut*).
42. *Lepus*, the *Hare*.
43. *Columba*, the *Dove*.
44. *Canis Major*, the *Greater Dog* (*a*, *Sirius*).
45. *Argo*, the *Ship*.

The Satellite of Neptune.—From similar observations of Neptune's satellite Prof. Hall obtains for Neptune a mass

$$= \frac{1}{19092 \pm 64}$$

computing the mean distance of the satellite at 16″·2699.

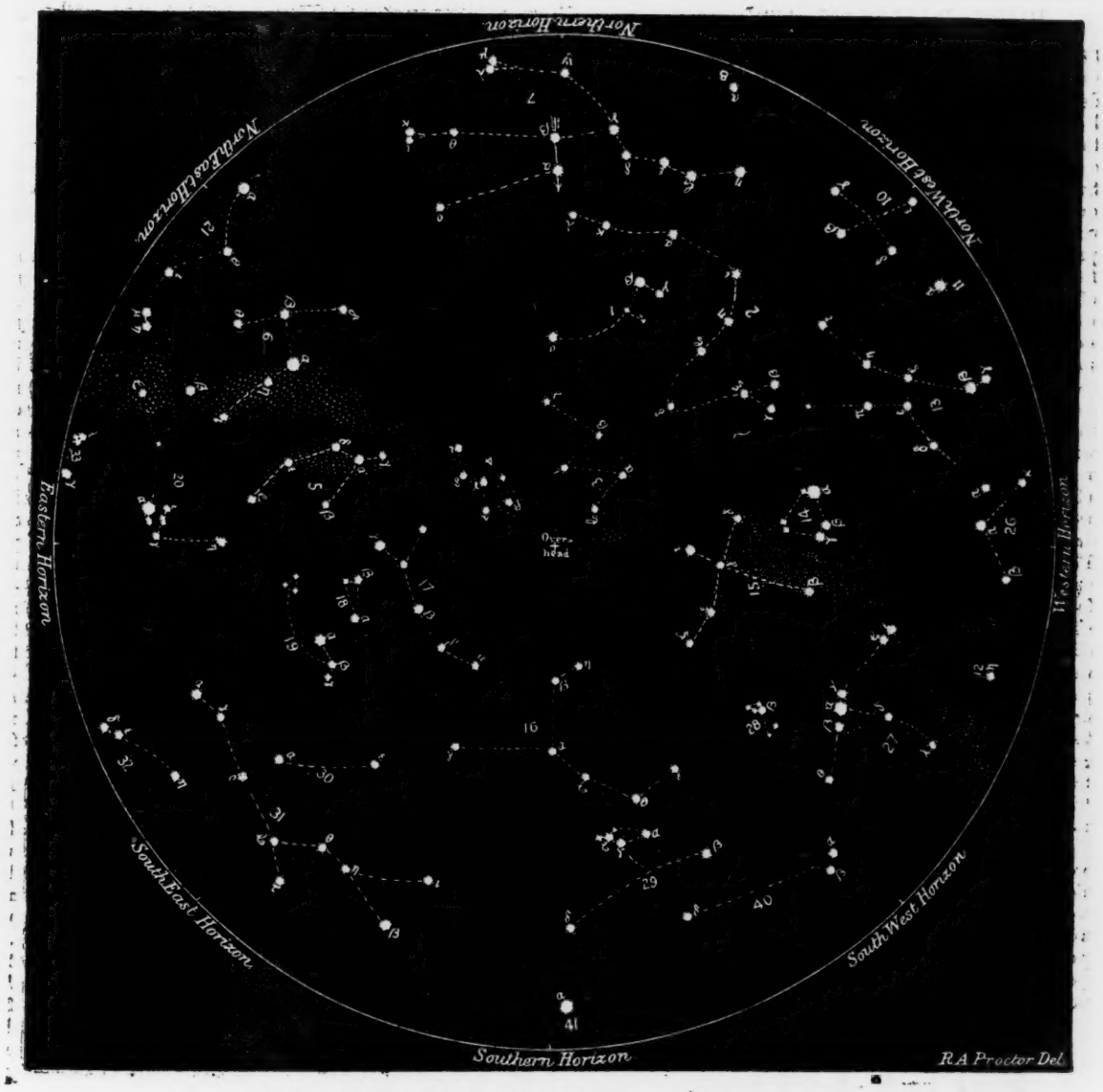
$$N = 184°{\cdot}314 \pm 0°{\cdot}1233$$

$$I = 120{\cdot}052 \pm 0{\cdot}1019$$

Period = 5·876839 mean solar days.

Newcomb's value = 5·8769 so that the correction is very slight. Prof. Hall found the satellite an easy object with the great refractor (26 inches in aperture) when more than 10″ from Neptune. He looked in vain during 1881-1884 for any other satellite.

The Satellites of Uranus.—From a careful discussion of the movements of Oberon and Titania, the sa-



NIGHT SKY FOR OCTOBER (First Map of Pair),

Showing the heavens as they appear at the following hours:—

At 10 o'clock.....October 7.	At 9½ o'clock.....October 19.	At 8½ o'clock.....October 30.
At 9½ o'clock.....October 11.	At 9 o'clock.....October 22.	At 8½ o'clock.....November 3.
At 9½ o'clock.....October 15.	At 8½ o'clock.....October 26.	At 8 o'clock.....November 7.

tellites of Uranus, Prof. Asaph Hall, of the Washington Observatory, deduces the following results:—

$$\text{Mass of Uranus} = \frac{1}{22682 \pm 27}$$

The mass of the sun being the unit.

Prof. Hall obtained results so closely accordant as regards the position of the planes of the orbits of Titania and Oberon, that he thinks we may fairly regard these planes as coincident. He obtains for this common plane the following elements of position, N being the longitude of the ascending node, I the inclination, t the number of years since 1883·0:—

$$N = 165°·812 + 0°·0142t$$
$$I = 75·300 - 0·0014t$$

The values of the mean distances a, assumed in his computations were for

Oberon, $a = 41''·15$
Titania, $a = 31·46$

Careful search was made with the great refractor for new satellites during the favourable oppositions of 1881–1884, but none were found.

ROPE RAILWAY AT GENOA.*

THE construction of a rope railway on the Agudio system, at Genoa, from Balzaneto to the Madona della Guardia, has been sanctioned by the Minister of Public Works. One of the most important features in this scheme, and in which it differs from the line now in operation, on the Agudio plan, from Turin to the Superga, is that no stationary engine will be required, as Mr. Agudio, the engineer, intends utilising the power of the same locomotive that will be employed for bringing the train from Balzaneto to the foot of the incline to the Sanctuary, a vertical height of 700 mètres (2,296 feet). This power will be transmitted, as is the case with the Superga line, by an endless wire rope, driven at a high speed, to a specially-constructed apparatus, or "locomotore," which receives the energy thus conveyed to it, and utilises it for the direct haulage of the train. In this way, one of the principal drawbacks in the application of this system will be avoided, as the traffic on such lines is very variable, and the expense of keeping a stationary engine of at least 250 horse-power forms a serious item in the working expenses, and especially so on week-days or during the winter months, when the traffic must be small. The locomotive, which will weigh about twenty-six tons, will, after having brought the train from Genoa to the foot of the incline, be disconnected, and taken on to a siding, where, by a suitable arrangement, it will be lifted off the rails, and its driving-wheels will bear on and be supported by other wheels revolving in fixed bearings placed below the level of the rails. The motion of the driving-wheels of the engine will be thus communicated to the wheels below, which, being connected by suitable gearing with the pullies for driving the rope, will thus transmit the energy developed by the locomotive to the "locomotore," or driving-car attached to the train, and use it for hauling up the train.

Under these conditions, the locomotive will, whilst working as a fixed engine, no longer have a large proportion of its power absorbed in drawing its own dead weight, and, therefore, if only 150 horse-power are utilised whilst drawing the train, consisting of three passenger carriages, containing 150 persons, its useful power will easily be increased to 250 horse-power when it no longer has a dead weight of twenty-six tons to drag.

* Society of Arts Journal.

LIVE-BURIAL.

By Dr. W. Curran.

THE origin of sacrifice, human and otherwise, is lost in the dim obscurity of the past. When first we hear of it in connection with the sacrificial acts of Cain and Abel it is spoken of as a familiar thing, a matter of course, and its previous enactment or existence is taken for granted. It was subsequently practised as a part of the ceremonial observance or law of the Jews, and other primitive or pagan worships, and it is now, as every one knows, the mainstay and corner-stone of the Greek, Roman, and other Christian denominations or rituals. That human beings were formerly sacrificed to appease the anger of some offended god, or remove such diseases as leprosy, small-pox, epilepsy, &c., is tolerably certain. They were also sacrificed for the purpose of staying the ravages of the plague, enabling their votaries to overcome their enemies in battle, and bring back fertility to their exhausted fields or flocks.* It would not, indeed, be easy to define the conditions under which they were *not* resorted to at one time or another by different tribes or peoples, and the whole subject is learnedly discussed in the "Victimæ Humanæ" of Jacob Gensius, of Groninghen, to which I am indebted for some of the illustrations recorded below. It is certain from this and other sources that the enforced or voluntary live-burial of human beings formed no inconsiderable part of these cruel rites.

That interruption to the true course of conjugal love that is caused by the death of the husband was probably the first cause of these immolations. The bereaved wife could not or would not survive her husband. The family crone or the family priest was at hand to encourage her in the practice of this laudable vow or wish; and Pomponius Mela expressly tells us that the wives of the polygamous Scythians contended amongst themselves as to which of them should first be buried along with her lord and master. Herodotus and Lucian are equally explicit in their ascription of a similar spirit of contention to the wives of the Thracians and Thrausians; and it is now generally understood that the original idea of saté was simply that of sending a favourite wife to keep company with her husband after death. When the ancient Scythians buried a king—says Mr. Wheeler†—they strangled one of his concubines and buried her with him, together with his cup-bearer, groom, &c. Amongst the Thracians there existed a still more significant custom. Every Thracian had several wives, and whenever a man died a sharp contest ensued between his wives as to which of them he loved the best. She who by her vows or wailings enlisted the largest amount of sympathy or support from the assembled crowd of courtiers won the coveted prize, and marched exultingly to her horrid doom.

Peter Martyr—who had special opportunities of knowing the facts—tells us that the ancient Americans buried the living babe in the same grave with its dead mother; and Saxo Grammaticus informs us that an acquaintance of his, one Asmundus, had himself shut up in the tomb that covered the remains of his friend Avitus. Similar stories are told by travellers of the struggles that took place for this privilege among the retainers of certain African kings. The main incident of the play of "The Illustrious Stranger" turns upon an episode of this kind; and it is, I fear, pretty certain that similar scenes may still be witnessed at the Court of Dahomey and elsewhere in the interior of that dark continent. Many savage peoples also buried their captive enemies alive, especially so if they had previously lost several

* Another and, I believe, an erroneous motive has been assigned by Mr. John Morley for the employment of this practice among savages. Alluding to the treatment of Sir Stafford Northcote by Lord Salisbury, he is reported in the *Standard* of July 14th last, to have said that, "when it was conceived by these savages that their old people had lived long enough, or, if they had the indelicacy not to recognise this fact themselves, and refused to make a choice between strangulation and being buried alive, then, without further ceremony, the tribe took the matter into their own hands" and buried their recalcitrant old kinsfolk alive. They did no such thing, Mr. Morley. They were not such fools as you take them to be, and such an exhibition of disinterestedness, decency, or humanity would be scouted by your Fuegian, Figian, or other "aboriginal" savage of that type. They would eat them instead; and I am not sure that civilisation has yet hit upon any more economic expedient for disposing of the dead, or more sanitary mode of sepulture than this is.

† "The History of India from the Earliest Period," vol. i. pp. 69-70. See also Ibid, vol. iii. pp. 89-91, in the same direction.

friends or relatives; and we know from Livy, Pliny, Juvenal, and a host of other Roman writers, that the vestal virgins who committed themselves, *vivae pro victimis obruebantur, ut hoc defossione scelus hoc (incastitatis) expiaretur; et divinae irae reatus hoc flagitio contractus solveretur.*

Herodotus further mentions that Amestris, one of the wives of Darius, who would appear to be losing her hold through advancing years on the affections of that monarch, caused fourteen of the children of her principal nobles to be buried alive, "ad referendam," as this writer quaintly puts it, "pro se gratiam deo;" and Porphyry ascribes a similar custom to an Arabian tribe, which he calls the Deomactii. Readers of Horace will remember that his witch, Canidia, buried the boy she had stolen up to his chin, so that she might be thus the better enabled to extract a love-potion out of his marrow and liver; and, describing the eunuchs of Peru and the houses in which the so-called "Daughters of the Sun" were secluded, old Purchas says (his "Pilgrimage," p. 883) that "if any of the Mamacomas—the young virgin nuns—or Aellas were found to have trespassed against their honour, it was an inevitable chastisement to bury them alive, or to put them to death by some other cruel torment."

Dwelling on some of the strange scenes he witnessed on his arrival in India, soon after our first settlement at Surat, Dr. John Fryer says ("An Account of India." London: Trübner. Page 378) that, "at Hubly, in this kingdom, are a cast called Liugints, whose wives . . . . are set in the same pit (with their dead husbands), covered up to the shoulders with mould; who, after ceremonies performed, have their necks wrung round, and the pit filled up with earth immediately." And saté would, after all, appear to be an improvement on this. For there is no doubt that saté was in many cases a purely voluntary act, inasmuch as the doomed widow might have escaped with life if she chose. But then she would probably have become an outcast, or worse; and it is at any time a case of Hobson's choice between live burial and live burning. Superstition of the grossest character could alone reconcile a frail woman to such a dreadful alternative or ordeal; but it is, we know, capable of even worse things than this; and "the facility with which men and women persuade themselves of a religious sanction for what they wish to do, however cruel and iniquitous, is not," says General Sleeman,* "unhappily, peculiar to any class or any creed."

Touching its enforcement as a punishment as contradistinguished from its ceremonial or sacrificial uses, the record is necessarily more scanty. I have only been able to collect a few cases in point, but many others must doubtless have escaped notice carent quia vate sacro, and the perpetrators of such hellish barbarities are either unknown to fame or they shrink from publicity. Moreover, live-burial as a punishment is now unknown to the law of any civilised country, and so we have to look to the past rather than to the present for such illustrations of this death penalty as are now available. Enumerating the obstacles Mahomet had to encounter and surmount, Sale says ("A Preliminary Discourse to the Koran," Tegg's ed., p. 17) that "one Abu Kabûs, King of Hira, ... in a drunken fit, ordered two of his intimate companions, who, overcome with liquor, had fallen asleep, to be buried alive," and live-burial was formerly —may still be, for all I know to the contrary, the penalty of red-handed homicide or murder in parts of Nepal and Tibet. Fr. Gruber, the Jesuit, as quoted by Mr. Clements Markham,* is my authority in regard to the former, and as to the latter Horace de la Penna, another Jesuit, says that "if the death of one of the parties (to a fight) is immediate on the quarrel, they—the neighbours or authorities—take and bind the murderer to it, and after twenty-four hours bury both the dead and the living together."

Coming nearer home, we find a very similar state of things. Thus, describing the customs of Ladak—now in Cashmere territory—Cunningham† says that, "in cases of killing in a scuffle in Ladak, the custom . . . was to bind the homicide to the corpse, and at the end of twenty-four hours to cast the living and dead together into the river"; but if this was not at hand, a hole in the ground took its place. Punishment in the East must, if it would be effectual, be short, sharp, and decisive, and those French or Italian adventurers—Avitabile,‡ Ventura, &c. —who kept the turbulent Punjabees in order for so many years under Runjeet Sing, thoroughly understood this necessity, and acted up to it. But this is not the place for a review of their *modus operandi*, and dwelling on the spirit and determination with which the once famous Begum Sumroo had raised herself from the doubtful position of a dancing-girl at the Mogul Court of Delhi to the musnud (throne) of Sirdhana, near Meerut, General Sleeman says—"The Rambles and Recollections of a Bengal Officer," vol. ii. p. 385—that, "while she was encamped with the army at Muttra, news was one day brought her that two slave-girls had set fire to her house at Agra, in order that they might make off with their paramours, two soldiers of the guard she had left in charge. These houses had thatched roofs, and contained all her valuables, and the widows, wives, and children of her principal officers. The fire had been put out with much difficulty and great loss of property, and the two slave-girls . . . were brought out to the Begum's tent. She had the affair investigated in the usual summary form; and their guilt being proved to the satisfaction of all present, she had them flogged till they were senseless,

* "A Journey through the Kingdom of Oude," vol. ii. p. 250.

* "Narratives of the Missions of George Bogle and Thomas Manning," pp. 299-300 and 325.

† "Ladak," by A. Cunningham, p. 263, and describing the punishments inflicted on criminals and others in Tibet, Mr. A. Wilson says—"The Abode of Snow," pp. 181-2—that "one mode of putting to death, which is sometimes inflicted, struck me as the most frightful instance of diabolical cruelty I had ever heard of. . . . The criminal is buried in the ground up to the neck, and the ground is trampled on round him sufficiently to prevent him moving hand or foot, though not so as to prevent him breathing with tolerable freedom. His mouth is then forced open, and an iron or wooden spike, sharpened at both ends, is carefully placed in it so that he cannot close his mouth again. Nor is the torture confined to leaving him to perish in that miserable way. Ants, beetles, and other insects are driven to take refuge in his mouth, nostrils, eyes, and ears." And it would appear from Bishop Bigandet's "Life or Legend of Gaudama, the Budha," p. 243, as if live-burial was employed as a regular punishment, for even trivial offences, in the early days of that otherwise mild and tolerant creed—Buddhism.

‡ An old inhabitant of Peshawur assured me that he had more than once seen as many as six corpses suspended by the neck of a morning on one of the bastions of that fortress by this man's orders; and 'tis certain that he (Avitabile) required a whole regiment for his escort, whether he went abroad or stayed at home, so much was he hated or feared. Sir Herbert Edwards "heard ("Life of Sir Henry Lawrence," vol. i., p. 291.) citizens of Peshawur tell how a follower, who had insulted some member of the General's harem, was forthwith ordered to be hurled down from the top of a minaret." The wretch was hurled, but contrived somehow, when half-way down, to seize a projecting cornice, and scream thence to his punisher for "mercy for the sake of God," Avitabile, unmoved, replied, "God may have mercy on you if he likes; I'll have none; throw him off the ledge." And thrown off he was accordingly.

XUM

and then thrown into a pit dug in front of her tent and buried alive."

Local tradition adds that she slept over their grave the following night; but this story lacks confirmation, and she had not, I believe, conformed at this time to Christianity. Whether she had or not would make no great difference, for Christianity has not changed the hearts of women any more than it has those of men in this respect, and it may be doubted if Paganism or any other cause has produced worse specimens of feminine humanity than are to be found in the familiar pages, to go no farther, of Finlay and Froude. However that may be, there is not much to choose between being buried alive, or being blinded or burnt alive; and we know that these mild processes were rather freely enforced for conscience or empire's sake, by more than one of our model Christian heroines. Live-burial would also appear to be preferable as a punishment to those cruel half-hangings and quarterings that were sanctioned by our laws down even to a recent period, and the Begum's summary action will bear favourable comparison, any day, with that of her Christian sister, Brownrigg, who

> . . . . whipped two female prentices to death
> And *buried* them in the coal hole.

Thirty-seven lighthouses have been built round the island of Newfoundland during the present century, of which eleven have been erected during the last seven years. Two new lighthouses are in course of erection, and the estimates for two more have been voted.

Wire Gauges.—A motion was brought forward at the recent convention of the American Telephone Exchange Association to adopt the English standard wire gauge, in order to be in uniformity with European nations. It met with strenuous opposition from several members, who thought the American gauge was all that was required; but it was eventually agreed to.

Death of Mr. Walter W. Weldon.—Mr. Walter W. Weldon, F.R.S., Chevalier of the Legion of Honour—one of the five men, and the only foreigner, whom the French Société d'Encouragement has deemed worthy of its "grand medal"—died on Sunday, at the age of fifty-three. He had been for some time afflicted by mental disorder, due, it is said, to over-work. To him the country is indebted for the process by which alone bleaching-powder is now made. The peroxide of manganese employed to liberate chlorine from the hydrochloric acid obtained in the first step of the soda manufacture was formerly thrown away. By a very simple process Mr. Weldon recovered from ninety to ninety-five per cent. of the manganese in a form available for renewed use, and thus saved nearly £6 on every ton of bleaching-powder made, quadrupled the total manufacture, made the industrial world the richer by some three-quarters of a million sterling per annum, and, as the French chemist, J. B. Dumas, publicly observed, "cheapened every sheet of paper and every yard of calico made in the world." No name was better known among the practical chemists in England, France, and Germany.

The Mineral Wealth of China.—Baron von Richthofen, who some time since explored fourteen of the nineteen provinces into which China is divided, has contributed to a Vienna review some interesting information as to the coalfields of the Celestial Empire. He says that while there is not a single province which does not contain more or less coal, the principal fields are in the southern half of Chan-si, in the south of Hunan, and in the west of Chan-Ting. The coalfields of Chan-si have an area of 14,000 square miles, and contain 730,000,000,000 tons. Taking the annual consumption of coal in the whole world at 300,000,000 tons, this coalfield alone would last 2,433 years, and in quality it is the best anthracite, superior even to that of Pennsylvania. In the south-east of the same province is another coalfield almost as extensive but the coal is more bituminous in quality. It is very easily extracted, and Baron von Richthofen adds that the Catholic missionaries at Tai-yuen, the capital of the province, pay only 3s. for a ton at the pit's mouth, though the cost of carting it to Tai-yuen is about double as much. He estimates the total extraction of coal at 2,965,000 tons for the whole of the eighteen provinces and Southern Mandchuria.

Gossip.

By Richard A. Proctor.

A correspondent asks how the distance of the sea horizon may be determined,—quoting the rule to the number of feet add half, the square root of the sun represents the distance of the horizon in miles. It is better to double than to add half; for owing to refraction six inches is much nearer the average depression for one mile than eight inches.

Assuming the optical depression per mile to be but six inches, what is the curvature of the light rays due to refraction? It is clearly such as to produce a deflection of two inches per mile. Wherefore, says another correspondent, if the earth were so much larger that the geometrical depression for one mile were only two inches the line of sight would bend just enough to correct the depression and we should be able to see right round, or all over the surface of the earth supposed to be smooth. "May not Satan," he proceeds, "when he arranged the panoramic view from an exceeding high mountain (unknown) have brought the whole world into view this way, by altering the refractive power of the air, so that the bending just corrected the geometrical depression?"

That is the sort of question continually poured in. One would imagine that the fallacy could deceive no one, and that the best reply would be,—"Oh bosh"—like the worthy bishop in the "Bab Ballads." But that answer, or one to that effect, was not held to be satisfactory. Truly the misapprehensions men make, even men of decent average intellect, about matters optical, are amazing. Here, for instance, is a man imagining the visual line, or a ray of light, capable of curving round a globe so as always to be at the same elevation, or where the air has the same density, though bending or refraction can only arise as the ray or visual line passes from air of one degree of density to air of a different degree!

Satan, then, could not be allowed to arrange any such unscientific trick, either now or in the old times when men were safe at any rate from Editors of Knowledge and from scientific lecturers.

By the way, it was *not* Satan, but the author of one of those "reconciling" books who tried to show that refraction might bring the sun into view round a whole hemisphere. This, of course, would bring him into view all round, or make him appear like a ring round the horizon, just as he would (*pace* Mr. Williams) to an inhabitant of the moon, if such there were, during a central eclipse of the sun by the earth.

Talking of odd mistakes, Mr. Williams's notion that at such a time two beams of sunlight, one going round one side of the earth, and the other going round the exactly opposite side, cross on the line joining the centres of the earth and moon *as at a focus*, is an odd one—though natural enough perhaps. I wonder how many readers of these lines will appreciate my remark on this point, that these two beams have as much connection with each other, so far as coming to a focus (properly so called) is concerned, as the last ray of the setting sun to-day with the first ray of the rising sun the day after to-morrow.

XUM

Reviews.

SOME BOOKS ON OUR TABLE.

Evolution without Natural Selection. By CHARLES DIXON. (London: R. H. Porter. 1885.)—The reader who takes up Mr. Dixon's little book in the hope or expectation that it is written to confute the imperishable theory of Charles Darwin, will find himself curiously mistaken. Rather does its author set himself to supplement that theory, and to clear up certain difficulties expressed in connection with it by its immortal originator. Particularly does Mr. Dixon insist upon the effect of isolation in the origination of species, and, postulating a primæval Polar centre, whence life radiated, shows how this factor would operate in the production of new forms of life. Climatic influences, sexual selection, and interbreeding, are dealt with in succession as originating species. *Ne sutor ultra crepidam*, and our author has done wisely in drawing his illustrations from birds alone, he being a professed ornithologist. There is much in this small volume worthy of perusal by the philosophical naturalist.

Wild Life in Canara and Ganjam. By GORDON S. FORBES. (London: Swan Sonnenschein & Co. 1885.)—In a modest and unassuming way, and without the slightest effort to be fine or flowery, Mr. Forbes gives us his experiences gained as magistrate and collector successively in Canara and Ganjam, taking mainly the form of hunting adventures. His hunting stories differ in no material respect from those of the multitude of Indian shikaris who have given their adventures to the world, but incidentally he furnishes, pleasantly enough, information as to certain districts and their inhabitants with which the ordinary English reader is far from being familiar. The illustrations, executed in some form of chromography, show skies, seas, and lakes so blue, grass and trees so green, and sunsets of such unparalleled brilliance, as would almost have made Turner tear his hair with envy.

Programme of Technological Examinations, Session 1885–86. City and Guilds of London Institute for the Advancement of Technical Education. (London: Gresham College.)—So far as we have been able to test this Syllabus, the course of study prescribed, and the character of the examinations proposed to be held in the various subjects to the teaching of which the Institute is devoted, would seem to be well chosen and most efficient. It is much to be hoped that the percentage of rejected candidates will be very much in defect of what it has been in the case of the examinations so far conducted by the Institute since its formation.

Handbook of Practical Telegraphy. By R. S. CULLEY. Eighth Edition. (London: Longmans, Green, & Co. 1885.)—The fact that this work has reached its eighth edition is proof positive of its general utility and excellence. The new edition, as compared with the preceding one, is almost a new book, a large portion of it having been re-written, in order to bring the handbook up to date. The recent improvements in quadruples and fast-speed automatic apparatus are ably dealt with; indeed, to get as near as possible to the existing state of affairs, the author, who long since was compelled by his advanced age to sever himself from actual work, has secured the invaluable aid of Messrs. Graves, Preece, and Chapman. Although the book still remains to be written which shall teach the telegraphist all he ought to know, Mr. Culley's effort is far and away superior to anything else in the market, so far at least as the British operator is concerned.

Manual of Telegraphy. By W. WILLIAMS, Superintendent of the Indian Government Telegraphs. (London: Longmans, Green, & Co. 1885.)—The great difference between this and the work previously noticed, affords considerable evidence of the extent of the field which will have to be covered by the author who succeeds in embracing the whole subject of telegraphy in a single work. The volume under notice has been written by order of the Director-General of Telegraphs in India, and is based on the substance of the papers on technical subjects set by the author at the General Examinations of the Indian Telegraph Department. These subjects embrace a general description of the various instruments, batteries, and circuits which the telegraph official may be called upon to deal with; faults which may be met with, and their remedy; testing, and the electrical phenomena which interfere with communication. The work affords a means of self-education, and forms a text-book of ready reference. A study of the manual cannot fail to reveal to the reader something of the different considerations under which telegraphy is carried on in India as compared with England. We should have been pleased to see a few more illustrations; but, all things taken into consideration, the work is a highly creditable one, and worthy of study by every one interested in the subject.

In the Watches of the Night. Poems (in eighteen volumes). By Mrs. HORACE DOBELL. Vols. 7 and 8. (London: Remington & Co. 1885.)—If Mrs. Dobell has sometimes been dismal and depressing in previous volumes of this series (and she has on occasion been *very* dismal indeed)—in those before us she is really and truly "like Niobe, all tears." Her verse trickles smoothly along, but in her endeavour to be pathetic she simply becomes lachrymose—a very different thing indeed.

The Strange Story of Eugenia, &c., by Miss H. H. COODE. (London: Griffith, Farran, Okeden, and Welsh).—Sensational as are the three stories of which Miss Coode's little book is made up, they never degenerate into vulgarity, nor into the mere blood-and-murder type of narrative, which but too often forms the modern substitute for the quieter and more decorous novel of our fathers. In the second tale, "The Necromancer's Hand," a weird idea is very cleverly worked out, and the end is decidedly "creepy." Readers in search of a sensation might do much worse than invest the modest price of Miss Coode's *brochure* in its purchase.

We have also on our table *The Journal of Botany, Ciel et Terre, The Sidereal Messenger, The Medical Press and Circular, Bradstreet's, The Sanitary News, The Tricyclist, Wheeling, The Country Brewers' Gazette, L'Echo* (with two pages devoted to science), *Electricité, The American Naturalist, Walford's Antiquarian* (as usual, full of matter of interest for the archæologist), *The Church of England Temperance Society and the Impending Electoral Contests, Gossip* (contains a column of "Science Jottings"), *Our Monthly* (Rangoon), *The Little One's Own, Progress, The Leeds Mercury, William Wesley & Son's Natural History and Scientific Book Circular*, T. B. Sprague's *Report on the Royal Liver Friendly Society*, and *Barr & Son's Catalogue.*

IT is estimated that the number of passengers carried by all the railroads in all parts of the world in 1882 was 2,400,000,000, or an average of 6,500,000 a day.

"Let knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

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The Editor is not responsible for the opinions of correspondents.

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MUSICAL STONES.

[1942]—The account of Mons. Baudry's Silex Piano in Knowledge of Sept. 4th, recalled to my mind an exhibition to which I was taken when a small child more than forty years ago. The so-called Rock Harmonicon was set up either in Bond-street or in Regent-street by its inventors, a father and his two sons, who were the performers. As far as my recollection serves me, these people were Welsh quarry-men, who accidentally made the discovery that certain stones had musical sounds. The key-board of this instrument (if one may call it such) was more than twice the width of an ordinary grand piano; it had two rows of stones, one above the other, like the white and black keys of the pianoforte; each performer had the command of at least one or two octaves. The effect was most pleasing and sweet; simple airs only were attempted. At this distance of time I cannot say what was the nature of these stones, but they had a greenish colour, and looked as if taken from the quarry, and roughly chipped here and there. It is possible that this might have been done purposely to give the exact tone required.

May I be allowed to differ from the editor of "Cosmos" when he states (as quoted in "La Nature") that the flint was the first arm, the first tool of pre-historic man?

Flint implements were, no doubt, largely used in pre-historic times, but no one can possibly know whether they were the *first* arm or the *first* tool of pre-historic man. Much would depend upon the geological formation on which any particular pre-historic race belonging to the Stone Age lived; they would naturally use any suitable stone which was near to hand; as, for instance, where the chalk formation was present we may reasonably expect to find flint implements in greater numbers than those of any other stone. Flint, too, has this great advantage, that it is comparatively soft and easily worked when first taken out of the chalk, and hardens afterwards. Flint implements would, probably, be better adapted for one kind of work than another; on the whole, they would not seem to be so widely spread as other varieties.

In Brittany, in Denmark, and in Guernsey, celts have been found made of various kinds of stone, viz., of diorite, of fibrolite, of a stone resembling basalt, and even of sandstone. In all three localities celts have been discovered made of a material which is known to exist no nearer to them than Hungary. It has been conjectured that such implements were regarded by their owners as valuable possessions, and transported on the person to the land where we now find them. Cosmopolitan.

INSTRUMENTAL MUSIC.

[1943]—Referring to the remarks of "Kolokol" and yourself in a late number of Knowledge on the subject of instrumental music, perhaps a few hints, founded on practical experience, may be of use. Accepting the limitations of "Kolokol's" conditions and desires, viz., age exceeding twenty-five years, no previous knowledge of the instrument, and a wish to take part in concerted music, I should say that with practice averaging an hour a day for twelve months (and even less) it is quite possible to attain sufficient execution on certain instruments to afford a large amount of satisfaction to oneself, and even of pleasure to other people. The pianoforte and the violin undoubtedly require a large amount of practice, and to be taken up at a somewhat early age, in order to attain the necessary agility of finger, but this agility is not nearly so requisite in the case, say, of the viola or the violoncello for concerted music, or the organ or harmonium for solo playing. I should recommend "Kolokol" to try the violoncello. He may feel discouraged just at first, but in two or three weeks' time he will begin to feel signs of progress, and in less than a year he will be able to play the bass part in Haydn's symphonies, and most of the 'cello part in the trios and some of the quartettes; and if he never gets further than that he will feel amply rewarded for his efforts. I speak from experience, as I was over twenty-five years of age, and busily engaged all day in a solicitor's office when I first took up the 'cello, and in less than six months I was able to join a small orchestral society, and enjoyed greatly our weekly practice of Haydn's and Romberg's symphonies, varied by an occasional easy overture or other lighter piece. I ought to mention, perhaps, that I was previously pretty well acquainted with the bass clef through choral singing, and I could play the harmonium in a humble way, but could never do much with the piano. I have since also learnt the viola, and find that a very gratifying instrument in orchestral music. The alto clef is somewhat of an obstacle at first, but one soon gets used to it. I can strongly recommend either of these instruments to any really musical person who has not much time for practice, and is not ambitious of brilliant solo playing, but who will find plenty of scope and reward in the comparatively simple (though expressive, and often grand), forms and passages of the older classical music.

W. H. E.

THE FLYING OF FISH AND HEAVY BIRDS.

[1944]—Induced by reading recent articles and correspondence in Knowledge, I should like to make known (if it be deemed of sufficient interest for its readers) the result of my observations on the flying of fish and heavy birds. Referring to notes in my diary, made on my first voyage to Chili, in a sailing ship, some ten years ago, I find that I came to the conclusion that the flight of the so-called flying-fish depended much (almost altogether) on the force of the wind. I took much interest in watching them from under the bowsprit of the ship. I noticed that during calms they seldom disported themselves above the surface of the sea, and that to get out of the way of the ship they scuttled off in all directions by a series of short, spasmodic jumps; but that as soon as a stiffish breeze sprang up they flew off in this manner: when going across the wind, the windward shoulder-fin was turned more or less upward, the leeward one downward; when going against the wind the shoulders of the fish were elevated; and when going with the wind their wing-fins were brought to a suitable angle to receive the wind underneath them, so as to get supported by it; the stronger the wind the longer they were enabled to remain in the air. As soon as I took up my residence in the northern part of Chili, I gave attention to the mounting and soaring of the condor and other heavy birds, with the view of applying my fish-flying theory to them and their prolonged soaring flights. I was at first disposed to think it inapplicable, for I saw these birds on the wing soaring about for hours together while a steady calm prevailed around throughout the day. I should mention that in the north part of Chili there are neither clouds in the air nor trees with foliage on the mountain sides to indicate that although near the level of the sea, where I was, a calm may prevail, when aloft in the stratum of air in which the birds floated a strong wind was blowing all the time. As soon as I had leisure to ascend the mountains (Cordilleras) some 4,000 feet or so I found that nearly a constant and strong wind was blowing at that height and above. At the heights frequented by the condor the atmosphere is so attenuated that considerable muscular effort is necessary to enable the bird to mount and sustain himself in the air without the force of the wind acting on the wings placed in suitable opposition to its direction. Indeed I have at times, when on the mountains and within about fifty yards of the bird, distinctly heard the rush of the wind passing the bird when no muscular movement of the wings was visible to account for the sound. The result of my observations goes to show that flying fish do not disport themselves in the air in calms, and as they do not flap their shoulder fins to support themselves, they require wind to sustain their flight, against which their wings are voluntarily placed in suitable apposition to it. And that the condor (and such like birds), whose habitat is on the mountains, where the air is much rarified, is unable to mount without muscular fatigue, and prefers inactivity to hard work until the wind rises, which compensates for the rarity of the atmosphere, when he delights to mount, and soar, and watch his prey from aloft. If, after mounting, he depended upon the reaction of the air alone through his descent by gravitation, he could not possibly sustain his soaring proclivities but for a

short time; but as an auxiliary to the wind, to which he also voluntarily places his wings appositely, it may be utilised as an aid.

Taltal, Chili, July, 1885. EDWARD MADGE.

SHOWER OF SNAILS

[1945]—Allow me to say a few words respecting the "shower of snails" which your correspondent, B. Reynolds, supposes to have fallen in Pembroke Dockyard on the 3rd inst. These snails, which he says "literally covered the ground," have been seen for weeks previous to this date, and have no doubt been there for years. They are of a small species, the largest not exceeding three-eighths of an inch in diameter. The plot of grass from which they crawled (and where they abound) is about twenty yards square. I heard the yarn a few minutes after the rain ceased, and believing such things possible, investigated the matter. It was evident at first sight that the story was false, though hundreds of the workmen yet believe it. As usual, after heavy rains, the snails had issued from their hiding-place. I can assure you thousands were carried away, and thousands yet remain to be seen. S. J. R.

A CHINESE MOTH.

[1946]—I have before me on the table a moth which has just flown in through a hole in the paper windows of a temple on the hills where the foreign residents of Peking are in the habit of passing the summer. His appearance is much the same as that of an ordinary moth. His wings are of a brownish colour, and his whole body, from the head to the tips of the wings, is about two inches in length. He differs, however, from any moth I have yet seen by having a thick bunch of hairs on his tail, or rather the end of his body. These are of a darker brown than the wings, and look very much like a horse's mane after it has been clipped, except that several hairs protrude above the others. The object of this brush is apparently to frighten any enemy which may meditate attack on the moth; for when anything is placed near his head, his whole body at once makes a sharp semicircular movement forwards, bringing the brush a little way beyond his head. He goes through this action several times in rapid succession, but ceases it as soon as the object of dread is withdrawn from before him. While the movement is taking place the rest of the body remains stationary, the raised part coming up between the wings where they meet on the back. The sudden appearance of a good thick brush, whirled rapidly backwards and forwards over the creature's head, would, no doubt, aid considerably in repelling the attack of any small foe.

I should be glad if any of your readers would inform me, through your widespread paper, if this moth is well known, and is found in other parts, or whether I am to look upon him in the light of a rarity, or merely in that of an "accident." E. T. C. W.

Peking, Aug. 2.

TWIN DANDELIONS.

[1947]—I have found, in a field near Lausanne, more than one twin dandelion, as described by "Ignoramus;" also a dandelion with four distinct heads and four stalks, which, growing together, formed one large square one. C. E. P.

FOOT CLOTHING.

[1948]—I thoroughly agree with Mr. M. Williams and your own remarks as to the difficulty of getting boots made to properly fit the feet. Unlike the other reformers of ladies' dress, of whom "Cosmopolitan" speaks [1935], I have given a great deal of attention to this matter. I need not now speak of the faults of fashionable high-heeled and narrow-toed boots, for they are apparent to all who have thought on the subject; but the so-called hygienic boots and shoes, and those made to fit even by good makers, are almost all spoiled by the fact that sufficient room is not left in the leather to allow for the breadth and thickness of the feet. I have been so dissatisfied with the boots that I have seen and tried on, even when made by the best makers, that I have arranged with one firm, Messrs. Marshall & Burt, of 444, Oxford-street, W., to produce boots and shoes specially made under my instructions, and I think that by doing this I am taking a step in the right direction; for, if one firm successfully starts an improved kind of boot, others will soon follow its example. I am devoting considerable space to this subject in my book on "The Science of Dress," which will be published immediately. In further reference to the letter of "Cosmopolitan," I may say that a medical friend of mine allowed his children, when young, to run about barefoot in the house, but had beautiful little morocco sandals made for them to wear out of doors. His children are now grown up, and their feet are quite perfect. I shall be greatly obliged if "Cosmopolitan" will send me the sandals like those of the Kashmiris, which he intends having made, as I should like to show them to the firm mentioned above. They may be sent to my address, 14, Tavistock-square, W.C., and I shall be pleased to receive any suggestions with which "Cosmopolitan" may favour me. ADA S. BALLIN.

LETTERS RECEIVED AND SHORT ANSWERS.

P. J. BEVERIDGE. "As near as I can make it out" was "inverted" as a form of expression needing to be separated from the rest of the text, and without the slightest reference to anything in any of your letters. "Quousque Tandem" was the signature of another correspondent: how you could imagine that a remark on the mustiness of Columbus's egg could refer to your particular view (no egg was ever found, I believe, in a mare's nest) I really am unable to conceive. However, it gave you an excuse for trying my *patientiam*, without inquiring how far *I* was responsible for the objectivity of your infinitively accusative charge. As to Darwin's theory and your defence of your objection thereto, you are free to maintain it *ad lib.* It pleases you; and it satisfies me—that I was quite right in remarking that you misunderstood Darwin. Because he did not think it necessary to explain that by small advantages he did not mean infinitely small advantages,—because, in fact, he treated his readers as reasonable beings—you feel free to attribute to him the absurdity of asserting that no matter how small some difference may be it will eventually produce a large difference. Because a giraffe with a neck one inch longer than his fellows had a real advantage in browsing, and, this telling, the necks of giraffes became eventually as long as we see them—therefore, a giraffe with a neck one millionth of an inch longer than its fellows' would have had a better chance of surviving, and millionths of inch may have been added, according to Darwin, till eventually the full gain accrued. Darwin did not draw the line anywhere, because, no doubt, he assumed his readers to have some degree of reasoning power, and to be able to draw it for themselves. As a mere matter of fact, it is obvious that the development of a finite advantage in a finite number of steps (and I suppose you do not imagine the number of generations of any animal from the beginning of its race to the end, or till now, to be infinite) must demonstrably have required finite steps, not the infinitesimal ones you imagine. And now I would ask you what offence either I or the readers of KNOWLEDGE have committed, that my time and their space should be employed defending Darwin's theory against such attacks as you fondly imagine yourself to have made?—COMMENTATOR. You must excuse me if, since your offence in regard to George Eliot, I see your communications with some degree of prejudice.—A HUMBLE ADMIRER OF HERBERT SPENCER. Those essays were printed in America in company with Mr. Frederic Harrison's; but the latter objected (and no wonder when we consider the figure he presented): so Messrs. Appleton, at Mr. Spencer's request, cancelled the volume. I am quite with you about Mr. Spencer's discussion of religion, and hope to show it in these columns soon.—A. J. S. The apology is ample. The "last straw" came long since; the camel's back, indeed, was not and is not broken; but he has given up all idea of carrying the load. Three weekly kicks, and he is rid of it.—J. L. GREEN. Surely that has not happened often. Anyway it will not happen with KNOWLEDGE monthly.—LAW. HARGRAVE. The acting editor will be sorry, I expect; yet tickled too. Upside down with or without care: as Pip and Joe Gargery would say, "Wot larx!" Yet I am myself so interested in the question of flight, that I hope soon to hear from you that your trochoidal system has been successful, and that in their high flight they have led folks—in Sydney—to say "What! *larks?*"—JOHN BULL. Mr. Browning is an optician; the other a seller of optical instruments. I know little of the instruments sold by the latter: but can confidently advise you to trust in the former.—H. O. C. Science recognises an absolute zero of temperature; but it would take more space than can here be given to explain how and why. Thanks for notes on America.—JAS. BURN. The stars may be inhabitable worlds, in the same sense that a white-hot furnace may be. Spiritual existences might there emulate our old friends Shadrach, Meshach, and Abednego. Your theory on the production of heat has *not* a leg to stand upon.—INSPECTOR-GENRAL. Theory rather too wild for us. I should want a better mirror to see the other side of the moon.—S. H. HOLDEN. Declined with thanks; will be retained a week for stamped and directed envelope.—F. COWLEY, NIL DESPERANDUM, C. M. DU CROZ. Have no knowledge on the subject.—J. M. At once too complicated and too inexact.—T. R. CAMPBELL. I noticed that review of "Modern Science and Modern Thought" in the *Times*, and the passage you quote. Of course it may mean those particular rocks which were so deported; but the whole article suggested that

the writer was very ignorant of science, and had but a smattering even of theology.—Victor Horsley. Very gladly find space for your very interesting and suggestive letter.—R. Lewins. Emphatically no; there will not be full scope (as you expect and hope) for attacks on religion in the monthly series of Knowledge. You are careful to show what you think you see bad and mad in all religions; *I* hope to show what there is and has been that is good. You see we differ widely.—J. H. Garfit. Of course, it was not really a shower of snails.—B. Considering that I have expressed just that view of Mr. Spencer's teaching in my essay on Happiness, I certainly agree with you.—Nigel. I have not the remotest notion which would be the best way to get the flesh entirely off a mouse. Try making him editor of a new weekly series of Knowledge.—Arthur Mee. It is a phenomenon of diffraction, if I understand your description rightly.—Hallyards. 1. I decline to insert your letter opening with the remark that you have not read the letter to which you refer. 2. "Forbearing to think out" a subject is scarcely the way to escape what you call "repression." If you will kindly think out the effect of the near approach of Number Last of Weekly Knowledge ("For this relief, much thanks!"), you will perceive that with serial matter which *must* be closed; with letters pouring in by the bushel from others, and a number of yours still in hand—I fear this will never be out of hand in the sense of appearing, I have to repress quite a quantity of matter. I certainly don't propose to publish a supplementary number for outstanding letters, of the class which killed Cock Robin. 3. The church idea won't hold; inconsistent with known dynamical laws. 4. Like you, I do not see the use of considering brandy-drinking alone; your long letter on "Comparative Ebriety" considers nothing else, however.—H. O. C. *Who* says comets consist principally of carbon? They *do* try to cool; but the sun warms them up again. What on earth, or in earth, has the earth's opacity, present or past, to do with the question of her possible past or present volcanic energy? No; the cooling down of a comet in no sense or degree explains its non-return.—Hercules. Dr. Ball was wrong. But, for myself, I do not care two straws how a man calls his stars. There is enough affectation in the world without bringing the poor stars in. Of course with the planets we must be more careful. Fortunately there is only one planet over which one can go wrong (as ninety-nine out of a hundred do,—saying Uranus instead of Ūrănus); for no one I suppose will speak of Jew Peter.—E. B. V. Our column for queries of that sort long since closed.—Quosque Tandem. Permit me to explain that my bad writing, causing some one looking up, or partially recalling (imperfectly it would seem) the passage, led to the very remarkable Latinity of my reply to you.

Our Whist Column.

By "Five of Clubs."

ON WHIST STRATEGY.*

(*Continued from p. 279*).

THE third class of cases to be considered is when the suits are unequally divided in length, and victory or safety depends on success in either ruffing from one hand while partner's hand retains defensive trump strength, or in establishing a cross-ruff. A contest of this kind is interesting and instructive. Nearly always we find that the hasty attempt to make tricks by ruffing through the early lead of a singleton or from a suit of two defeats itself. The enemy see their danger early, and by leading trumps put an end to your ruffing tactics. A cross-ruff can scarcely ever be secured by over-hasty leads from short suits. Where there is a fair chance of a cross-ruff, it is quite commonly lost though a singleton lead.

The third and fourth of our doubly-played hands illustrate the play of hands in which the suits are irregularly distributed. In the former four tricks are lost by the lead from a singleton, while by correct play only the odd trick is lost. In the latter, a cross-ruff is on the cards for *A B*, and if they secure it by correct play they win four by cards: but *A* leading over hastily to secure a ruff, the cross-ruff is missed, and *A B* lose two by cards.

It often happens that two suits are equally distributed between the hands, one hand only having more than three cards, while the other two suits are irregularly distributed. Again it often happens that, while the hands of two players, partners or otherwise, are very unevenly distributed, those of the two others are hands of three-card suits and one four-card suit. Success in securing victory or safety often depends on the early recognition of such peculiarities of arrangement.

* From the Author's forthcoming work on "Home Whist."

Nearly always it is well, while you are still in doubt about the arrangements of the hands, to follow the rules, "Force the adverse strong trump hand;" "Force your partner if you are strong in trumps;" Refrain from pressing him if you are weak;" "Trump a doubtful card (that is, a card in a suit of which your partner may or may not have the best card) if you are weak in trumps, pass it if you are strong." But you must be quick to recognise when occasion arises for the use of even a fairly strong trump hand in ruffing. You may only be able, for instance, by ruffing from four trumps (the only case in which there can be doubt) to force your partner's weak trump hand. Again it occasionally happens that when you are weak in trumps you may only be able by leading trumps to give your partner the power of forcing you by which the only ruff open to you may be made. Thus do we see all rules go by the board when occasion arises,—the strong hand ruffing, the weak hand leading trumps, and so forth.

Towards the close of a hand everything may depend on properly placing the lead. Here familiarity with certain typical positions is desirable.

Suppose you hold the best, third best, and a small card, either in trumps or in a plain-card suit when trumps are out, the second, fourth, and a small card being on your left, and the other players holding no cards in the suit. Then if you lead the best card you make but one trick, if you lead the small card you make two.

Again suppose your partner holds the best and third best trumps and a winning card in a plain suit, opponent on your left holding second and fourth best trumps and a losing card in the same plain suit, while you hold two trumps and a losing card in another plain suit. Your partner leads his winning card, or the player on your left leads his losing card (it matters not which): if now you let your partner's card take the trick, he must lead a trump, and one of the other tricks will go to your opponent on the left. But if you trump his winning card, and lead either the other trump or your losing card, both the remaining tricks go to your partner.

Remember that if you hold the best guarded and your partner third best guarded, or *vice versâ*, in a suit of which one of the opponents has the second best guarded, that second best card must make if led up to in the suit, but will fall if the third best is led through it: if it lies on the left of the best, it will only fall if led from.

Be careful in noting where the strength lies in the various suits. By retaining the inferences made early in the game, you can judge which cards to retain and which to discard. It is idle to retain the King-card in a suit which cannot be led again: yet we sometimes see such a card held, and a small card thrown away in another suit of which that small card was an essential protection. To take a very simple illustration, suppose that after trumps are all out the cards arranged as follows, *Z* knowing where the Spades lie and that all the Diamonds are out except his Ace:—

B holds: Spades—9, 5; Hearts—K.

Y holds Hearts—Q, Kn, 10. *Z* holds Spades—8, 2; Diamonds—A.

A holds: Hearts—4, 3, 2.

A leads a Heart, *B* winning with the King; if now *Z* discards his Diamond Ace he must make a trick in Spades; but if he discards the Deuce of Spades both the remaining tricks go to *B*.

A winning card or an extra trump which if retained will compel you to win a trick and then lead from a tenace or up to the enemy's tenace should if possible be got rid of. Suppose for instance the following arrangement (Hearts trumps):—

B's hand: Hearts—4; Spades—Q, 9, 3.

Y's hand:	*Z*'s hand:
Hearts—3;	Hearts—10, 8;
Spades—5;	Spades—7;
Clubs—A, 4.	Clubs—9.

A's hand: Hearts—Kn, 9, 2; Spades—10.

Y leads Club ace, B trumps with the four, *Z* plays Club nine; if now *A* discards the Spade Ten, he must win the next trick, and lead from his tenace, losing one trick in trumps. But if *A* discards the small trump, *B* wins the next trick with the Spade Queen, and *A* makes both the remaining tricks, *Z*'s minor tenace being led through. Observe that a trick is gained in this way, even though *Z* hold the major tenace and *A* the minor. If for instance *Z* holds Queen Ten, instead of Ten Eight, then by discarding the Spade, *A* is obliged to take the next trick and lead up to *Z*'s major tenace, losing both the remaining tricks; but if he discards the trump Two, undertrumping his partner, *B* makes the next trick with the Spade Queen, and leading through *Z*'s major tenace, *A* makes one more trick. If instead of holding the above hand, *A* held Knave and Ten of Hearts and Spade King and Ten, his proper play to the first round would be Spade King, so that *B* would win the next trick with the Spade Queen.

Throwing away thus a winning card is called playing the *Grand Coup*. It is akin in principle to the lead of the losing card from the major tenace guarded (best, third best, and small card).

Our Chess Column.

By Mephisto.

THE SCOTCH GAMBIT.

We herewith give a few examples of our attempt at meeting the attack of 7. Q to Q2 in this Opening. The actual games played have, however, not been sufficiently numerous to enable us to form a definite opinion as to the merits of Black's defence.

ILLUSTRATIVE GAME No. 13.

1. P to K4	P to K4
2. Kt to KB3	Kt to QB3
3. P to Q4	P × P
4. Kt × P	B to B4
5. B to K3	Q to B3
6. P to QB3	KKt to K2
7. Q to Q2	Castles

A very risky move, which, as will be remembered, led to a lost game in the encounter between Blackburne and Gunsberg at Hereford. Black, however, in that game continued with Q to K4. In the present instance, however, Black gives up two Pawns, in the hope of profiting by his superior development. Until we have further thoroughly tested this variation, we should not like to pronounce in its favour.

8. Kt to Kt5	B × B
9. Q × B	P to Q4
10. Kt × BP	R to Kt sq.
11. Kt × P	Kt × Kt
12. P × Kt	B to B4 !
13. Q to B3	

We are of opinion that 13. Q to Q2 would have been a much safer move for Black.

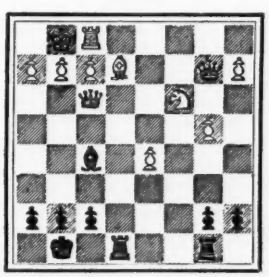
	KR to K sq. (ch)
14. B to K2	Kt to Kt5
15. P × Kt	

If 15. Kt to R3, Kt to Q6 (ch). 16. K to B sq., Kt × P with a good position.

	Q × P
16. Castles	Q × R
17. Kt to B3	to Kt7

and Black won.

White.



Black.

GAME No. 14.

The first ten moves same as in No. 13. In order to avoid the attack consequent upon 11. Kt × P, Kt × Kt. 12. P × Kt, B to B4 or Kt to Kt5. White in another trial played—

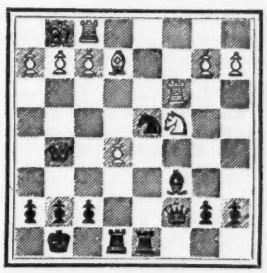
11. Kt to Q2	P to Q5
12. P × P	Kt × P
13. R to B sq.	B to Q2
14. P to K5	Q to QKt3
15. Kt to B4	Q × Kt
16. Q × Kt	Kt to B4

If Black plays P to Kt4 at once, White may play 17. R to Q sq.

17. Q to Q2	QR to B sq.
18. R to B3	KR to K sq.
19. B to K2	B to B3
20. Castles	QR to Q sq.
21. Q to Kt5	Kt to Q5

The game resulted in a draw, as Black won the centre Pawn.

White.



Black.

GAME No. 15.

The first ten moves same as in No. 14. Not being quite satisfied as to the effects of Black's next move, he varied his tactics as follows—

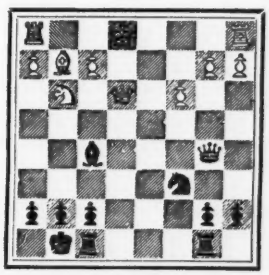
11. Kt to Q2	P × P
12. Kt × P	Q to K4
13. Kt to QKt5	Kt to Q4
14. Q to K2	

There is no other move to avoid P to B4.

	Kt to B5
15. Q to K3	B to B4
16. Kt to Kt3	Kt × P (ch)
17. B × Kt	Q × Kt

and Black won.

White.



Black.

Some highly interesting tries were played in this variation. We hope soon to be able to say whether the attack gained by Black on White playing 10. Kt × BP is sufficient to compensate him for the loss of two Pawns.

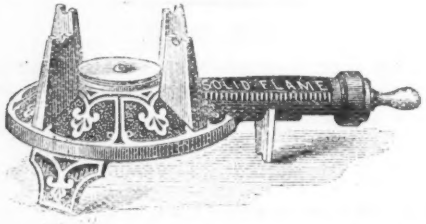
A New Use for Toads.—The latest and most ingenious way of getting rid of roaches and water-bugs we have heard of is related of a citizen of Schenectady, whose kitchen was infested with them. A servant, hearing that toads were an antidote, caught three ordinary hop-toads, and put them in the kitchen. Not a roach or water-bug, it is stated, can now be found in the house. The toads have become domesticated, never wander about the house, and are so cleanly and inoffensive that there is no objection to their presence. Another use for toads is to employ them for insect destroyers in the garden. They are determined enemies of all kinds of snails and slugs, which it is well known can in a single night destroy a vast quantity of lettuce, carrots, asparagus, &c. Toads are also kept in vineyards, where they devour during the night millions of insects that escape the pursuit of nocturnal birds, and might commit incalculable havoc on the buds and young shoots of the vine. In Paris toads are an article of merchandise. They are kept in tubs, and sold at the rate of two francs a dozen.—*Scientific American.*

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (KNOWLEDGE *being a popular magazine) than is accorded by the most excellent trade journals.*

HEATING BURNER.

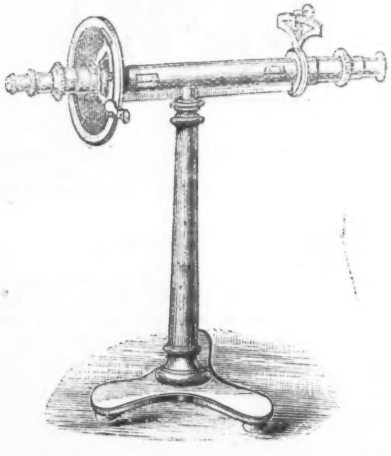
(Patent No 7,121. 1884.)—In this invention, by Mr. S. Siddaway, of 9, George-street, West Bromwich, a plate is fixed just above the frame as shown, leaving a small orifice all round between the two



for the escape of gas to be ignited. Gas is supplied through the jet, air entering through a hole beneath the inlet jet: for large burners more than one gas inlet jet may be used.

POLARIMETER.

[Patent No. 14,699, 1884.]—In this instrument, patented by Thomas Bayley, of the firm of Allen & Bayley, 7, West-end Chambers, Broad-street-corner, Birmingham, the novelty is an arrangement whereby all the advantages of a Polarimeter on the principle of Laurent are obtained at less expense. The instrument is essentially a Laurent's, but in place of the half-wave plate of quartz cut parallel to the axis of the crystal, a single thin sheet of mica is employed. The mica is selected by optical methods, and when properly mounted is said to



be indistinguishable from the quartz plate, even to the experienced eye. The half-wave plate of quartz requires great skill on the part of the workman, and is practically unobtainable in England. The accompanying illustration shows a cheap Polariscope on this system; it is graduated with vernier to read to minutes, and has an adjustment to vary the illumination of the field. Another instrument with rackwork adjustments is also made. The advantages of the instrument are decrease of cost, and the fact that monochromatic light is used with direct measurement of the angle of rotation of the analysing prism as in the Laurent instrument.

WASHING CLOTHES.

[Patent No. 10,768. 1884.]—In this invention by Mr. E. Taylor, 43, Canning-street, Bury, Lancashire, a plunger is arranged to force air through the clothes in a wash-tub. A metal tube is connected to a conical part open below; at the bottom of the tube a ball valve is arranged, opening downwards only. When the plunger is forced down among the clothes the included air closes the valve, and is forced through them.

In order to render glue insoluble in water, even hot water, it is only necessary, the *Scientific American* says, when dissolving glue for use, to add a little potassium bichromate to the water and expose the glued part to the light. The proportion of bichromate will vary with circumstances; but for most purposes about one-fiftieth of the amount of glue will suffice.

Mr. R. A. Proctor's Lecture Tour.

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3. THE MOON
4. THE UNIVERSE.
5. COMETS AND METEORS
6. THE STAR DEPTHS
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Each Lecture is profusely illustrated.

Communications respecting terms and vacant dates should be addressed to the Manager of the Tour, Mr. JOHN STUART, Royal Concert Hall, St. Leonards-on-Sea.

Oct. 2, Chester; Oct. 3, 17, Malvern; Oct. 6, 9, 12, 13, Plymouth; Oct. 7, 10, 14, 16, Torquay; Oct. 19, 22, 28, Salisbury; Oct. 21, 26, 29, Southampton; Oct. 23, 27, 30, Winchester. Oct. 31, Marlborough College.

Nov. 2, Chester; Nov. 3, 5, 7, Southport; Nov. 4, Burnley; Nov. 9, Stafford; Nov. 10, Streatham; Nov. 12, Middlesbrough; Nov. 17, Darwen; Nov. 19, Saltaire; Nov. 23, Bow and Bromley Institute; Nov. 24, Trowbridge; Nov. 25, 28, Bath; Nov. 26, 30, Clifton.

Dec. 2, 5, Bath; Dec. 4, Clifton; Dec. 7, 8, 9, Croydon; Dec. 11, Chester; Dec. 14, Dorchester; Dec. 15, Weymouth; Dec. 16, 17, 18, 19, Leamington.

Jan. 12, Hull; Jan. 15, Stockton; Jan. 26, Bradford; Jan. 27, Busby (Glasgow).

Feb. 3, Alexandria; Feb. 4, Rothesay; Feb. 5, Chester; Feb. 6, 20, Malvern; Feb. 9, 12, 19, Cheltenham; Feb. 10, Walsall; Feb. 11, Wolverhampton; Feb. 15, Upper Clapton; Feb. 18, 25, London Institution; Feb. 22, Sutton Coldfield.

March 1, 3, 5, Maidstone; March 3 (afternoon) and March 6 (afternoon), Tunbridge Wells.

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